BENEFICIAL USE ASSESSMENT
PER STATE WATER RESOURCES CONTROL BOARD
ORDER WQ 87-3

January 1988

California Regional Water Quality Control Board
Central Valley Region
3443 Routier Road
Sacramento, CA 95827-3098

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SUMMARY

In March 1987, the State Water Resources Control Board directed the Central Valley Regional Water Quality Control Board (SWRCB Order WQ 87-3) to reconsider the beneficial use designations for ground water in the vicinity of Kesterson Reservoir in Merced County. Specifically the order asks the Regional Board to 'consider establishing beneficial uses which distinguish between the upper and lower ground water aquifers'. The basis for the request was preliminary evidence submitted by the United States Bureau of Reclamation that indicated the upper aquifer was of marginal quality which did not support current beneficial use designations, and that the vast majority of ground water users were taking water only from the better quality lower aquifer.

The San Joaquin River Basin Plan, adopted in 1975, designates the ground water basin in the vicinity of Kesterson Reservoir to extend over most of Merced County east and west of the San Joaquin River and portions of Fresno County west of the river. A review of the hydrogeology in the ground water basin and the vicinity of Kesterson Reservoir shows an upper and lower aquifer system which is separated by the extensive Corcoran Clay layer. The upper system (above the Corcoran Clay) has many clay lenses but is considered one aquifer because these lenses are intermixed with coarser materials and no continuous barrier to flow exists. This is evidenced by recent monitoring at Kesterson Reservoir where leakage from the site has migrated to a depth of 120 feet in spite of shallow clay lenses below the site. Because the subsurface geology is basically the same throughout the ground water basin, the present study was concentrated within a five mile area around the Kesterson site. This allowed a more detailed appraisal of localized beneficial use.

A field survey of water use by aquifer revealed that there is extensive use of both the upper and lower aquifer for municipal and domestic supply, irrigation supply, stock watering and industrial process supply. Each of these uses is already designated in the Basin Plan. Each use was found to be more extensive from the upper aquifer than from the lower. For the study area as a whole, of the 137 wells with known depths, 74 percent of the wells are drawing their supplies exclusively from the upper aquifer. A similar pattern of use was found both upgradient and downgradient of the Kesterson Reservoir site. In addition to the designated beneficial uses in the Basin Plan, the field survey showed extensive ground water use or potential use for creating or maintaining waterfowl or wildlife habitat.

Approximately 45 percent of the actively used wells in the study area were sampled for major minerals, boron, and trace elements to confirm the SWRCB preliminary finding that designated beneficial uses may be limited by existing water quality. In addition, salinity measurements were made on 75 percent of the active wells in the study area. The salinity level was found to be the most limiting factor for beneficial use. Approximately 40 percent and 80 percent of the sampled wells drawing water for domestic purposes from the upper and lower aquifers, respectively, exceeded the EPA recommended maximum drinking water criterion of 1,000 mg/L. The salinity data however, does not show the water to

be of a quality which precludes beneficial use as the EPA criterion is primarily based on taste and not a public health concern. The median salinity for all wells tested from the upper and lower aquifers is 800 and 1300 mg/L, respectively. Isolated areas of poorer quality water do exist, especially in the upper 20 feet of the upper aquifer due to localized evapoconcentration, but its quality is unlikely to affect beneficial use of the remainder of the upper aquifer water.

The data did not show that trace elements in either the upper or lower aquifer pose a major limitation to the beneficial use of ground water within this study area. Only four wells of the 89 tested showed trace element levels exceeding established safe levels for their present beneficial use. Two of these were irrigation wells which only slightly exceeded safe levels. Boron was found to be elevated throughout the study area. As with salinity, the highest median values for boron occurred in water being extracted from the lower aquifer rather than the upper aquifer.

RECOMMENDATIONS

1. The ground water aquifer in the study area is similar to the remainder of the ground water basin designated in the Basin Plan and should not be considered separately for beneficial use designations.

2. The beneficial use designations in the Basin Plan are all existing beneficial uses within the study area and should not be modified.

3. The designated beneficial uses of the ground water are active uses in both the upper and lower aquifers in the study area; therefore, the Regional Board should not consider setting separate beneficial use designations for each aquifer.

4. The beneficial use for waterfowl and aquatic habitat is an existing beneficial use in the study area and throughout the Basin Plan designated ground water basin. The Regional Board should consider adding this beneficial use during the Basin Planning update process but should recognize that as with other designated uses, existing water quality does not always meet criteria established for this use.

5. The quality of water being extracted for beneficial use from the upper aquifer was found to be of equal or better quality than that used from the lower aquifer; therefore, the Regional Board should not consider removing beneficial use designations because of water quality. The Regional Board may want to consider noting in the Basin Plan that quality occasionally does not meet the established safe levels but this has not limited beneficial use.

6. Because existing water quality periodically approaches or exceeds established safe levels in the study area, the Regional Board should maintain a strong regulatory program for ground water protection in the area to prevent degradation which would limit beneficial uses.

7. Approximately 30 percent of the wells located in the study area were abandoned wells. The Regional Board should request the Merced County Health Department to increase its efforts to assess whether these wells should be properly abandoned and sealed in accordance with their present well ordinance.

BENEFICIAL USE ASSESSMENT

INTRODUCTION

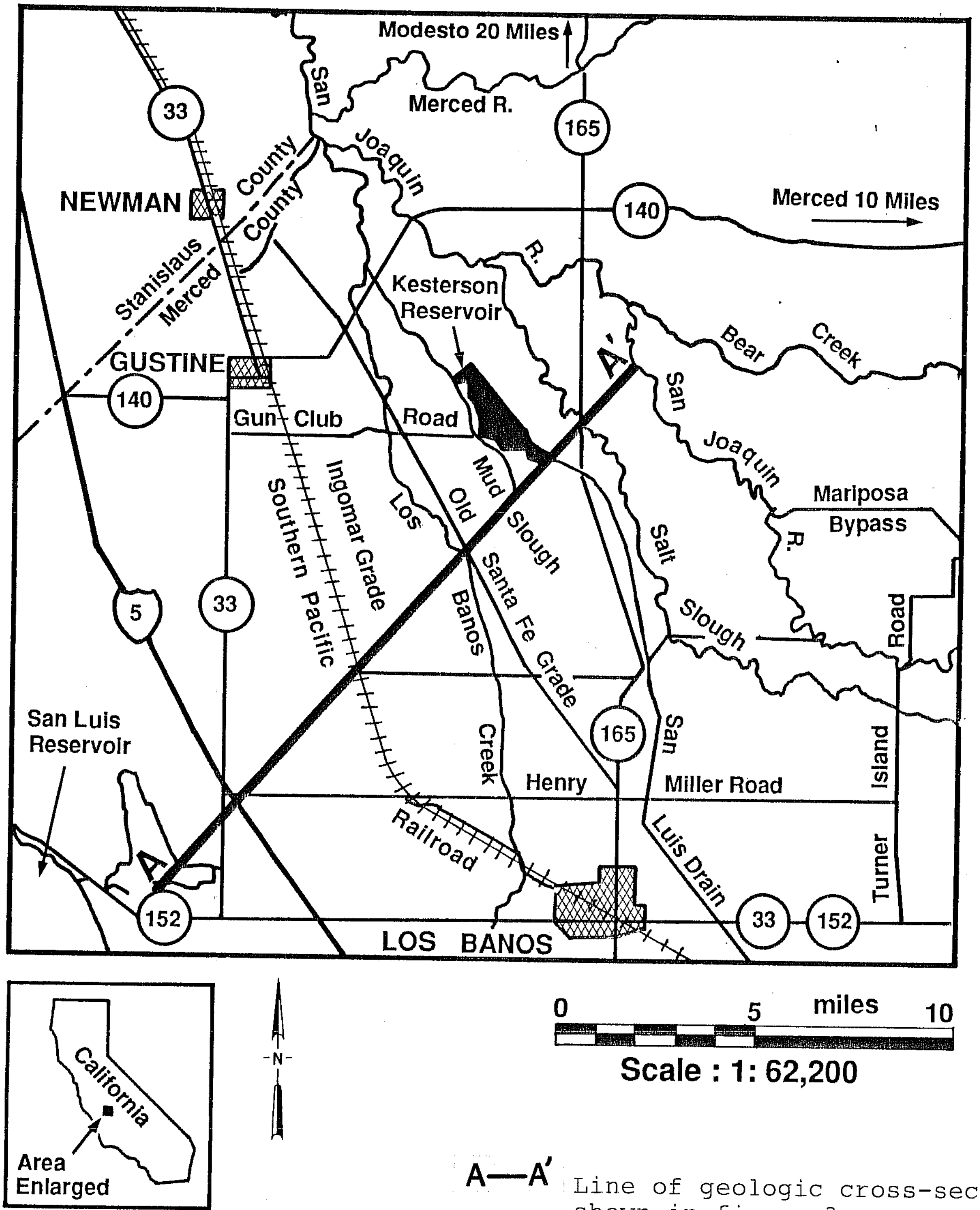
The State Water Resources Control Board (State Board) Order No. WQ 87-3 (adopted 19 March 1987) directed the U.S. Bureau of Reclamation (Bureau) to close Kesterson Reservoir and construct an on-site landfill for disposal of contaminated sludges, soil, and vegetation, and remanded the matter to the Central Valley Regional Water Quality Control Board (Regional Board). The Order also directed the Regional Board to reexamine the beneficial use designations in the Water Quality Control Plan Report (Basin Plan) for the ground water zones underlying the Kesterson Reservoir area. The general location of this area is shown in Figure 1. Specifically, the Order asks the Regional Board to 'consider establishing beneficial use designations which distinguish between the upper and lower ground water aquifers.' Beneficial use designations would then be used to establish the extent of actions taken by the Bureau to mitigate the effects of past leakage from Kesterson Reservoir on the surrounding ground water basin.

The beneficial uses of the ground water basin in the Kesterson area are identified in the Basin Plan as municipal and domestic water supply, irrigation supply, stock watering, and industrial process supply. These beneficial uses apply to the entire ground water basin and are not designated for specific water bearing zones. However, evidence received during the State Board hearings and the Environmental Impact Statement for the Kesterson Project suggest that water quality of the upper water-bearing zone may be unsuitable for beneficial use, and that the deeper confined water-bearing zone serves as the major source of drinking water in the San Joaquin Valley and the Kesterson Reservoir area. The evidence indicated that the upper water-bearing zone has historically been of marginal quality with a total dissolved solids level averaging 4,000 ppm and comparatively high trace element concentrations. Although the upper zone was reported to be of poor quality, the Bureau found considerable ground water use from this zone within two miles of Kesterson Reservoir.

STUDY AREA

The San Joaquin River Basin Plan designates the ground water basin in the vicinity of the Kesterson Reservoir area to extend over most of Merced County and a small portion of Fresno County west of the San Joaquin River. Because of the localized effects of Kesterson Reservoir, it was decided that the boundaries of the study area would be extended approximately five miles around Kesterson Reservoir (Fig. 2). This area represents both the upgradient and downgradient conditions surrounding the site and allows for a sufficient buffer from localized pumping and recharge effects. The area is bounded by the Newman Wasteway to the north, the San Joaquin River to the east, Ingomar Grade (Southern Pacific Railway) to the west, Wolfsen Road to the southeast, and extends three miles south of Township Line 9 South to the San Luis Spillway.

The purpose of this study was to identify the existing beneficial uses of the ground water within the study area. Earlier hydrogeological reports about the area were reviewed to help define the ground water system. All water supply wells that could be located within the study area were identified and their uses recorded. Water quality samples were taken from many of these wells to determine whether quality is sufficient for their existing beneficial uses.



A—A' Line of geologic cross-section shown in figure 3.

Figure 1. General location map.

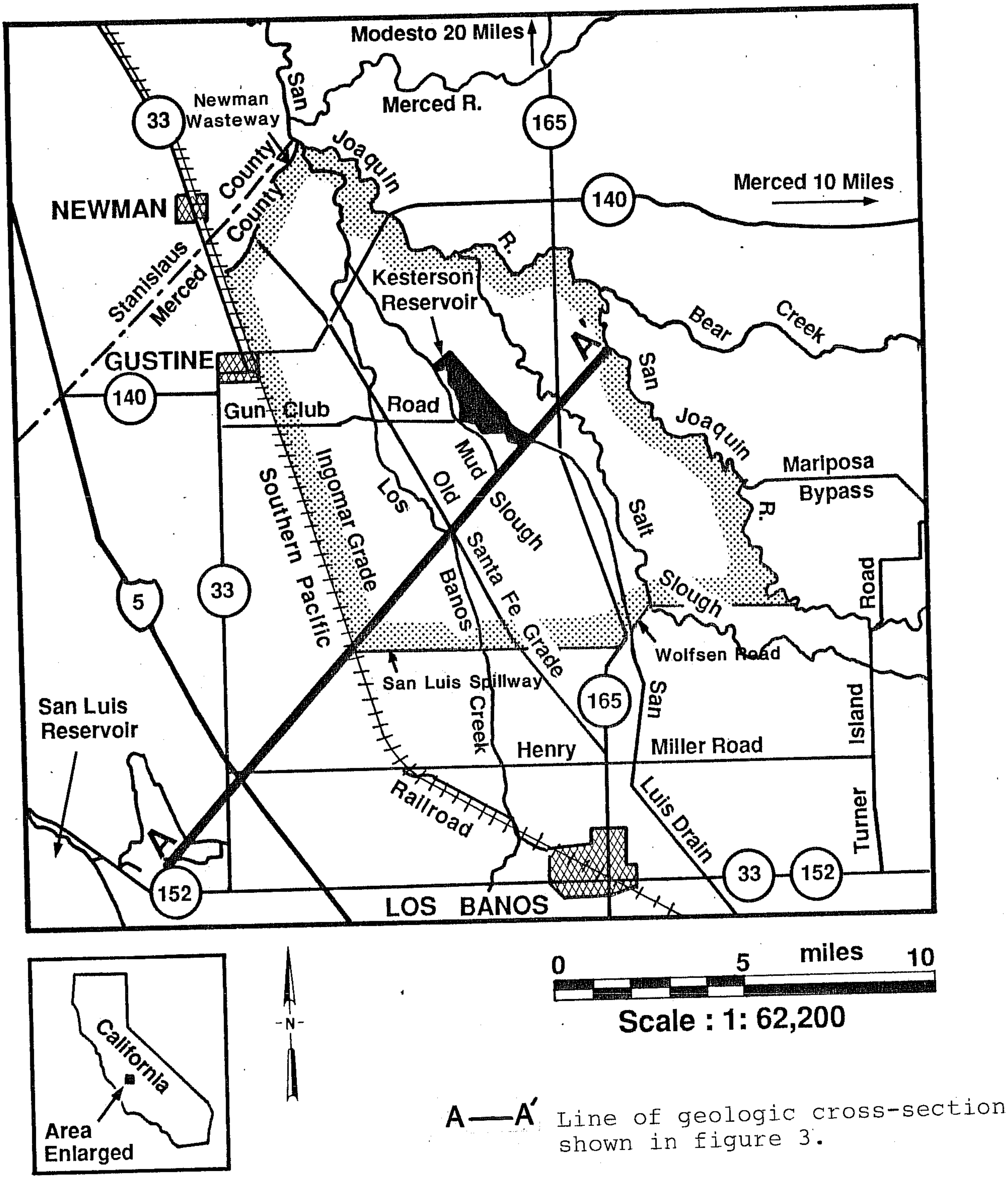


Figure 2. Study area map.

Monitoring wells were not included, because water from these wells is not used for beneficial uses as defined in the Basin Plan. Therefore, water quality data in this report represents water extracted for beneficial use, and does not represent the water quality of the entire aquifer system.

GEOLOGY

GEOLOGIC HISTORY

The geologic history of the San Joaquin Valley and the Kesterson Reservoir area is closely related to the histories of the Coast Range and the Sierra Nevada mountains. In the Early Jurassic Period, approximately 185 million years ago, compressional tectonic forces caused the earth's crust west of the present day Sierra Nevada to downwarp, forming a shallow water coastal basin that received huge quantities of sediments over the next 125 million years. A thickness of up to 15,000 feet of sediments accumulated in this study area during the Cretaceous Period alone. About 60 million years ago, during the Early Paleocene Epoch, wedges of these earlier sediments were uplifted in many Coast Range areas creating the ancestral San Joaquin basin between the newly formed Coast Range and the Sierra Nevada. This basin was occupied by a shallow inland sea which received sediments from the two adjacent highlands. The lateral extent of this inland sea varied throughout time. On the western side of the San Joaquin Valley, around the study area, marine deposition was continuous until Early Miocene time, approximately 25 million years ago, when the sea retreated. The sea reentered this area for a relatively brief period in Late Miocene time, but by Pliocene time, approximately three million years ago, the sea had retreated again. Continental deposits have been accumulating in the study area ever since. It is these Pliocene to Holocene continental deposits that comprise the fresh ground water aquifer in the San Joaquin Valley.

GEOLOGIC UNITS

Consolidated Deposits

The consolidated deposits which underlie the unconsolidated fresh-water-bearing deposits in the study area consist of 15,000 to 20,000 feet of Pre-Pliocene sedimentary rocks. These deposits are exposed in the Coast Range foothills to the west and are first encountered at about 800 to 1,000 feet below the surface in the study area. The sedimentary rocks are predominately marine, consisting of conglomerates, sandstones, siltstones, shales, and mudstones. These deposits generally contain saline water.

Unconsolidated Deposits

The unconsolidated deposits are fluvial and lacustrine deposits of the Tulare Formation and overlying alluvium and flood basin deposits. These deposits range from a feather edge along the western flank of the valley to 1,100 feet thick at the valley trough. In the study area these deposits are between 800 and 1,000 feet thick. The fluvial deposits were transported by streams draining both the Sierra Nevada and the Coast Range. These streams were continually shifting channels so individual beds vary in thickness and character over short distances. These heterogeneous deposits are the chief water-bearing deposits along the west side of the San Joaquin Valley.

The Tulare Formation overlays the consolidated deposits and is composed of reworked sediments from the Coast Range interfingered with Sierra Nevada derived sediments. Coast Range sediments are not as well sorted and are generally less permeable than the Sierra Nevada sediments. Within the study area the Sierra Nevada sediments comprise the bulk of the subsurface deposits (Fig. 3). This formation consists of fluvial and lacustrine deposits. The fluvial deposits are generally discontinuous lenses of sand and gravel, sand, and silt deposited in stream channels and discontinuous layers of silt and clay from flood basin deposits. The lacustrine deposits generally consist of clays and silts deposited in swamps and lakes.

One lacustrine deposit, known as the Corcoran Clay Member of the Tulare Formation or the "blue clay", underlies the entire study area. It extends from north of Tracy south to the southern end of the valley. The extent of this clay layer west of Gustine is approximately one-and-one-half miles east of Interstate 5. The eastern extent is irregular but extends well beyond the study area. This clay layer is Pleistocene in age and is in the upper half of the Tulare Formation and it ranges from 180 feet below the surface just east of the San Joaquin River to 270 feet below the surface on the western edge of the study area. The thickness of the clay ranges from about 60 feet in the northern part of the study area to 120 feet at the southwestern corner. Laboratory analysis of core samples show it has a high porosity and a low permeability. The thickness, low permeability, and lateral extent make the Corcoran Clay an effective barrier to vertical movement of ground water.

The zone above the Corcoran Clay, up to the land surface, consists of unconsolidated sediments of variable composition which are very similar to the unconsolidated sediments below the clay layer. Within this upper zone three more continuous clay layers have been mapped along the west side of the San Joaquin Valley; however, none of these three beds are known to extend into the study area.

There are two clay layers underlying Kesterson Reservoir identified by Lawrence Berkeley Laboratory scientists and designated as C1 and C2. The C1 clay layer is a near surface deposit of limited lateral extent ranging from 10 to 20 feet thick. The C2 clay layer is about 80 feet below the surface and is approximately eight feet thick. It underlies most of Kesterson Reservoir but becomes intermixed with coarser sediments toward the eastern portion of the Reservoir.

HYDROLOGY

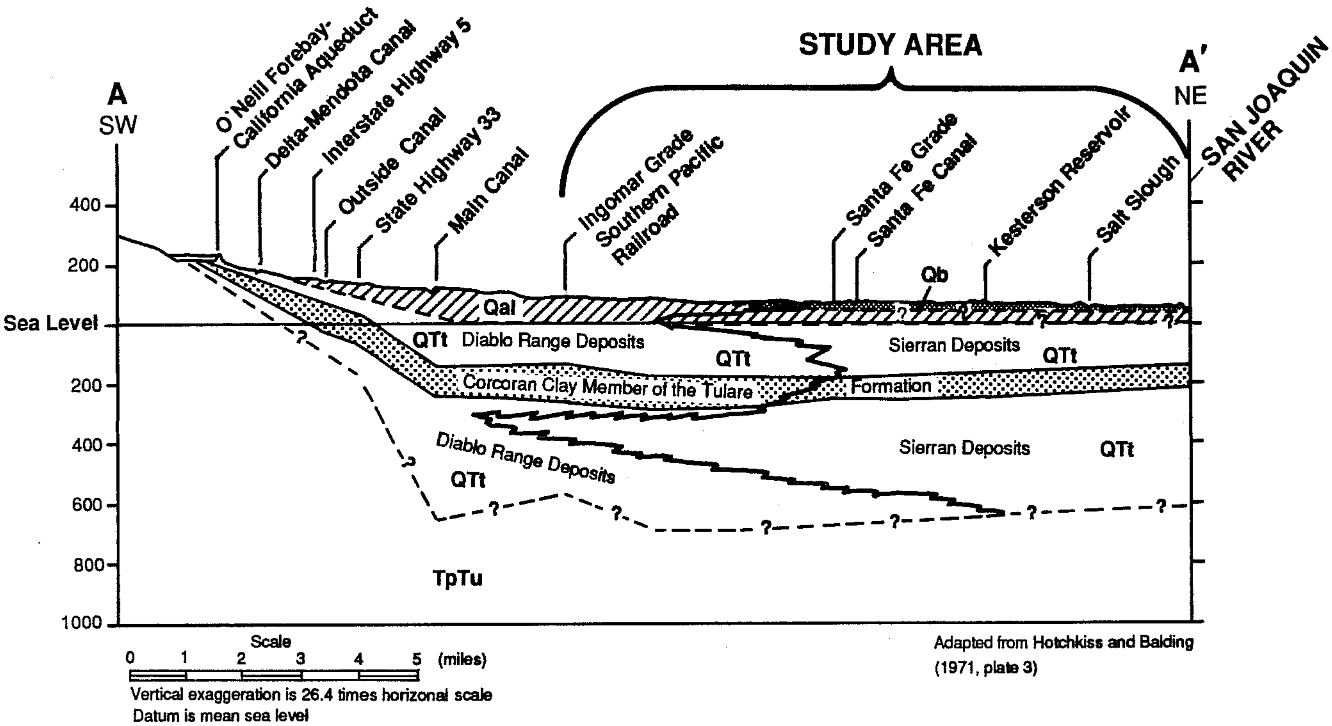
OCCURRENCE OF GROUND WATER

There are three distinct zones of ground water occurrence in this study area: 1) the saline zone, 2) the lower fresh water zone, and 3) the upper fresh-water zone.

Saline Zone

The saline zone is composed of consolidated marine sedimentary deposits which contain brackish or saline water. This zone underlies the usable fresh water throughout the valley. The top of the saline zone has not been identified in the study area, but it has been mapped at 800 feet below mean sea level immediately north of the study area. The base of this zone is undefined.

Geologic Cross-Section Through the West Central San Joaquin Valley



EXPLANATION

PLEISTOCENE and HOLOCENE

Qal

Alluvium

Qal, unconsolidated clay, silt, sand and gravel: permeable to moderately permeable

Qb

Flood-basin deposits

Unconsolidated surficial and near surface deposits of clay, silt, sand, and gravel: moderately to poorly permeable

PLIOCENE and PLEISTOCENE

QTt

Tulare Formation

Unconsolidated and semiconsolidated continental deposits, poor to well-sorted fluvial deposits of clay, silt, and gravel interbedded with lacustrine sediments: highly to variably permeable

UNCONFORMITY

PRE-PLIOCENE

TpTu

Sedimentary Rocks

Unconsolidated, semiconsolidated and well indurated continental and marine clay, silt, sand, and gravel; sandstone, siliceous shale; bentonite; claystone; carbonaceous shale: depth to this zone exceeds depth of most water wells in the area

Symbols

Boundary between source areas

Corcoran Clay Member of theTulare Formation

— ? — Stratigraphic unit contact queried where evidence is inconclusive

Figure 3. Geologic cross-section through the west central San Joaquin Valley.

Lower Fresh-Water Zone

The lower fresh-water-bearing zone in the study area contains confined water and extends from the base of the Corcoran Clay, ranging from approximately 260 to 370 feet below the surface, down to the saline zone.

The major source of recharge to the lower zone is infiltration from Sierra Nevada streams east of the eastern edge of the Corcoran Clay. Infiltration from Coast Range streams near the foothills may contribute minor amounts of recharge. Recharge by downward percolation of water from the upper water-bearing zone may also occur through abandoned wells, corroded well casings, gravel enveloped wells, and through the clay itself if the hydraulic head difference between the upper and lower zones favors downward flow. There are also a number of composite wells within the study area. These wells have perforation intervals both above and below the Corcoran Clay, and therefore, may act as conduits between the two zones when these wells are not in operation.

Upper Fresh-Water Zone

The upper fresh-water-bearing zone in the study area extends from the top of the Corcoran Clay up to the free-water table. Due to the heterogeneous nature of these deposits in this zone, unconfined, semiconfined, and confined water conditions have been reported.

A USGS 1971 Tracy - Dos Palos ground water study included a shallow water bearing zone where wells within about 25 feet of the surface had higher water levels than the deeper wells. These wells were in the alluvium and flood basin deposits that overlay the Tulare Formation. This shallow zone is not as apparent in the study area.

There is no strong evidence that a shallow ground water body exists that is isolated or separate from the upper water-bearing zone. Because of the heterogeneous nature of the deposits and the apparent discontinuous nature of the clay lenses in the upper zone, the entire upper water-bearing zone should be considered as one continuous aquifer system.

Replenishment of this upper zone within the study area is generally from infiltration from irrigation canals and ditches, deep percolation of excess applied irrigation water, and infiltration from flooded wetlands. Minor recharge also comes from seepage from west side streams. Annual precipitation is low and has a negligible effect in replenishing this zone.

MOVEMENT OF GROUND WATER

Horizontal Movement

Ground water movement in the lower fresh-water zone has shown some variation in the past few years. In 1985, the Bureau reported that the piezometric surface of the lower zone in the Kesterson Reservoir area had a westward gradient of approximately three feet per mile. Later water level data collected from four lower zone monitoring wells in the Kesterson Reservoir area showed a gradient toward the west in January and February 1986, but from March 1986 through June 1987, the gradient varied from south-southwest to south-southeast. There is a lower zone pumping depression southwest of Dos Palos which could account for the southward gradient. This change from west to south may also be due to a decrease in local lower zone pumping to the west.

In the upper water-bearing zone, within the study area, gradients are very flat ranging from a few feet to less than a foot per mile, and are generally toward the northeast. The direction of ground water flow can be altered by localized pumping.

Outward or subradial flow exists beneath ponded areas of Kesterson Reservoir due to ground water mounding. This subradial flow is very localized and the water is incorporated into the regional flow a short distance from the mounding. Although the area influenced by this subradial flow is believed to be small, the actual extent is unknown. At times some of this water may discharge to Mud Slough.

Vertical Movement

The direction of vertical movement varies depending upon the hydraulic head difference between the two zones. Water levels are generally lower in the lower fresh-water-bearing zone thus causing downward movement from the upper to the lower zone. In the Kesterson Reservoir vicinity this relationship appears to vary depending upon the time of year. Water level measurements made by the Bureau show that in late winter and early spring the piezometric surface of the lower zone can be higher than the water surface of the upper zone which would cause upward flow from the lower zone to the upper zone. The rate of vertical movement in the study area is not known. Possible conduits between the zones are abandoned wells, wells with corroded casings, gravel enveloped wells, and wells perforated both above and below the confining layer.

BENEFICIAL USE SURVEY

Regional Board staff located a total of 200 active wells and 105 abandoned wells within five miles of Kesterson Reservoir. The active well density is illustrated in Figure 4. All wells were inspected in the field and beneficial uses were determined through field inspections and interviews with property owners and/or tenants. Well depth and construction information were obtained through confidential Water Well Drillers Reports on file with the California Department of Water Resources, USGS reports, and through interviews with well owners. Previous uses of abandoned wells were also identified. Many of the abandoned wells had open casings which have not been sealed. Wells were considered abandoned if they were inoperative at the time of the survey, i.e., no electrical power, and will not be used for future beneficial use. Monitoring wells in or near Kesterson Reservoir and the San Luis Drain were not surveyed because these wells were not installed to extract water for beneficial use. A listing of the 200 wells presently being used in the study area is shown in Appendix A along with their present use. Often one well will have several designated beneficial uses. The well depths which are specifically known for each present beneficial use are summarized in Table 1. Ten tile drains in the study area are also listed in Appendix A. A listing of the 105 abandoned wells and their former use is shown in Appendix B.

Well locations are illustrated on topographic maps A-F in Appendix C. The following sections present a summary of beneficial uses identified in the study area including a discussion of present beneficial uses of wells downgradient of Kesterson Reservoir:

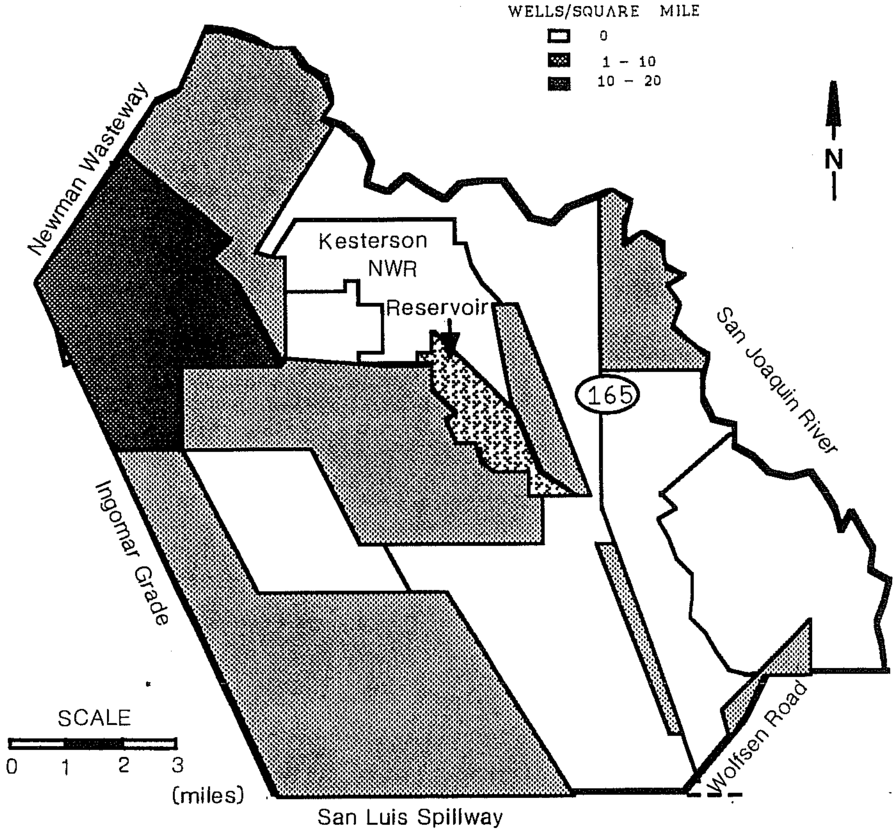


Figure 4. Density of wells in the Beneficial Use Assessment Area (Monitoring wells are not included as beneficial use wells)

Table 1. Well Depths and Beneficial Uses of Ground Water

WATER USE	AQUIFER ZONE*	TOTAL WELLS/ KNOWN DEPTH	MEDIAN DEPTH - FEET -	DEPTH RANGE
DOMESTIC	UPPER	77	140	25 - 250
DOMESTIC	LOWER	18	475	350 - 730
MUNICIPAL	UPPER	6	127	100 - 250
MUNICIPAL	LOWER	0	-	-
INDUST. PROCESS	UPPER	6	127	97 - 250
INDUST. PROCESS	LOWER	0	-	-
STOCK	UPPER	41	153	25 - 222
STOCK	LOWER	18	460	350 - 793
IRRIGATION	UPPER	18	170	70 - 233
IRRIGATION	LOWER	20	462	285 - 682
WILDLIFE HABITAT	UPPER	3	80	45 - 83
WILDLIFE HABITAT	LOWER	7	670	630 - 793

* Aquifer zone = water bearing zone in which well is completed
Composite wells which draw water from above and below the Corcoran Clay are not included.

MUNICIPAL SUPPLY

The City of Gustine is located five miles upgradient of Kesterson Reservoir. The City draws its water supply from six wells in the upper zone. The depths of these wells range from 100 to 250 feet below the surface. Four of the six wells supply all of the domestic water needs of the city. These four wells are immediately west of the Ingomar Grade, but they all supply water to the portion of the city which lies within the study area east of the Ingomar Grade. These four wells also supply process water to dairy product plants within the city. The remaining two wells are within the study area and are used for domestic purposes at the city airport and sewage treatment plant.

DOMESTIC SUPPLY

Ground water is the sole rural domestic water supply within the study area. Seventy (70) percent of the wells in the study area are used for rural domestic purposes. Specific well depths are known for ninety-five (95) of these wells. Seventy-seven (77) of the wells draw water from the upper water bearing zone, and eighteen (18) wells are completed below the Corcoran Clay. One domestic well is located downgradient of Kesterson Reservoir. Twelve (12) well owners reported using bottled water for drinking due to taste problems. However, in each case the well water was used for other domestic purposes. There are 36 duck clubs with cabin areas within the study area. Fifteen (15) of these clubs have permanent residents, and 21 clubs are occupied only during the waterfowl hunting season. Ten of the clubs have abandoned their wells and the hunters bring in bottled water for all domestic purposes.

STOCK WATERING

Cattle grazing is a major land use within the study area. The northern division of the Grassland Water District is located immediately west of Kesterson National Wildlife Refuge. The Grassland area is comprised of numerous private duck clubs which serve as important waterfowl wintering areas. Some of these duck clubs also lease their land for cattle grazing and pasture. There are several dairies within the area which supply their cattle with well water. Three commercial egg ranches and one turkey ranch rely on well water for their poultry. Horses and sheep are also supplied with well water. Forty-three (43) percent of the wells in the study area (86 wells) are used for stock watering. Specific well depths are known for 59 of these wells. Forty-one (41) of these wells tap the upper zone and range from 25 to 222 feet in depth. Eighteen (18) stock wells are completed below the Corcoran Clay with a depth range of 350 -793 feet. Two stock watering wells are located within one-half mile downgradient of Kesterson Reservoir. These wells are 125 and 154 feet deep.

IRRIGATION

The Central California Irrigation District (CCID) and Grassland Water District supply surface water for irrigation in part of the study area. In addition, 43 wells are used for irrigation of pasture and alfalfa within the study area. Pasture land irrigation provides summer cattle food and habitat for waterfowl.

The Gustine Drainage District operates four wells within the northwestern part of the study area. These wells are pumped continuously during the irrigation season to lower the high water table in the area. The water is used by local farmers for irrigation with the balance conveyed by CCID for irrigation supply and waterfowl habitat.

PROCESS SUPPLY

The Gustine municipal wells are used for process supply by dairy product plants within the city. A process supply well in the northwestern part of the study area is used in the formulation of concrete. One additional process supply well is at a meat processing plant northeast of Gustine. Although not direct process use, the dairies in the study area utilize well water for washing cows, equipment cleaning, and at times for cooling water.

WILDLIFE HABITAT

The Basin Plan designates wildlife habitat as a beneficial use of surface water but overlooks this use for ground water. Ground water is an important supplemental water supply at wildlife refuges throughout the Central Valley when surface water is short. However, high pumping costs preclude it as a major supply source for these wetlands. Fourteen (14) wells are presently used to provide supplemental wildlife habitat water within the study area.

DOWNGRADIENT GROUND WATER USE

A total of 14 wells are downgradient of Kesterson Reservoir. These wells are east of the Reservoir and west of the San Joaquin River.

The Freitas Ranch is immediately east of Kesterson Reservoir. There are a total of six known wells on this property; only three are functioning. Well 8S/10E-16Q2 is by the ranch headquarters at the east end of Gun Club Road. Bottled water is used for drinking at the ranch but the well water for all other domestic purposes. This well is also used for watering cattle and horses. Drilled in 1987, this well is 295 feet deep and perforated in a sand lens immediately below the Corcoran Clay. The upper portion of the well is sealed with bentonite. Two functioning stock watering wells are within one-half mile downgradient of Kesterson Reservoir. These wells (8S/10E-9P and 8S/10E-22L2) are upper zone wells of 125 and 154 foot depths.

There are three known abandoned wells on the Freitas Ranch. The first is a domestic well (8S/10E-16Q1) by the ranch buildings which was replaced in the spring of 1987. The depth is unknown, and the well has not been sealed.

The second abandoned well (8S/10E-22L) is located just south of existing stock well 8S/10E-16L2. This shallow well was abandoned due to a corroded casing. The well has not been sealed and flows artesian when the water table rises in the winter season.

The third abandoned well (8S/10E-21B2) is a monitoring well which was drilled by the Bureau of Reclamation in 1984. This well is completed below the Corcoran Clay and has not been sealed. Two PVC monitoring wells are immediately adjacent to this abandoned well.

Eight downgradient wells are east of Salt Slough and west of the San Joaquin River on the Gallo property. The Gallo wells were formerly used for irrigation but it is now uneconomical to irrigate this land. The land is now used to graze cattle. Seven of the eight wells (7S/10E-35E, 7S/10E-35N, 7S/10E-35P, 8S/10E-2J, 8S/10E-2P, 8S/10E-3J, and 8S/10E-11E) are completed in the upper water bearing zone with depths ranging from 156 to 188 feet. The eighth well (8S/10E-2R) is 276 feet deep and is perforated in both the upper and lower zones. All wells have pumps in place, but electrical power service to the property has been discontinued. The USFWS is attempting to purchase the property and expand the San Luis National Wildlife Refuge. This well field is therefore a potential wildlife habitat water supply.

WATER QUALITY ANALYSIS

Water quality samples were taken from 89 wells. This represented all known functioning wells between the Santa Fe Grade and the San Joaquin River and a representative transect of upgradient wells between the Santa Fe and Ingomar Grades. Nine tile drains were sampled as an indicator of near surface ground water quality. A minimum of three casing volumes were pumped from each well before sampling. Ten percent duplicates were obtained and 50 percent of the duplicates were spiked for laboratory quality assurance. Electrical conductivity (EC), pH, and water temperature were recorded in the field. Sixty-one (61) additional wells, all west of the Santa Fe Grade, were sampled for EC. Standard procedures for preservation of trace element samples were followed. Water quality criteria for the protection of beneficial uses are shown in Table 2. Results of the water quality analysis for minerals and trace elements are listed in Appendix D and E, respectively.

SALINITY

The major limitation to full beneficial use of water in the study area is salinity. Approximately forty (40) percent of the sampled wells drawing water for domestic purposes from the upper zone had a total dissolved solids level that exceeded the 1979 EPA recommended maximum of 1000 mg/l (EC = 1500 umhos/cm) for drinking water. In addition, eighty (80) percent of the sampled wells drawing water for domestic uses from the lower water-bearing zone (below the Corcoran Clay) exceeded this level. Salinity above the established EPA maximum level may not pose a health hazard, but is likely unacceptable due to poor taste. In the case of irrigation, the level of use restriction becomes severe when EC exceeds 3000 umhos/cm. In the study area, only one shallow irrigation well and one deep irrigation well exceeded this level.

Salinity measurements (EC) taken on 149 actively used wells throughout the study area showed wide variability ranging from 153 to 16,000 umhos/cm. Salinity from all wells with known depths is summarized in Table 3. In addition, the data in Table 3 is subdivided between the upper and lower water bearing zones for different regions of the study area.

Table 2. Water Quality Guidelines and Criteria for the Protection of Beneficial Uses

	Domestic/Municipal Drinking Water			Ambient water quality criteria to protect freshwater aquatic life		Irrigation Degree of Restriction on Use			Stock Water
	Primary	Secondary	Other (health)	4 day average	1 hour average	None	Slight to Moderate	Severe	
Constituent	- µg/l -			- µg/l - *		- mg/l -			- mg/l -
Arsenic	50			190	360	0.1			0.2
Boron						< 0.7	0.7 - 3.0	> 3.0	5
Cadmium	10			6.9	52.7	0.01			0.05
Chromium	50			11	16	0.1			1
Copper		1000		84.6	155.2	0.2			0.5
Iron		300				5			
Lead (inorganic)	50			59.4	1524	5			0.1
Mercury	2			0.012	2.4				0.01
Molybdenum			70	44		0.01			
Nickel				160 **	527 †	0.02			
Selenium	10			35 ** #	260 †	0.02			0.05
Silver	50				13 †				
Zinc		5000		47	570 †	2			24
TDS (mg/l)		1000 ††				< 450	450 - 2000	> 2000	
EC						< 700	700 - 3000	> 3000	< 5000

* Total recoverable metals, value not to be exceeded more than once every 3 years on the average

** 24 hour average not 4 day average. The Se critieria is currently being reviewed, and could be lowered to 2 - 5 µg/l.

Selenium as inorganic selenite.

† Maximum value not 1 hour average.

†† Maximum value (Recommended level = 500 mg/l; Short term level = 1500 mg/l)

(References: EPA, 1985a; EPA, 1985b; EPA, 1980; EPA, 1979; Ayers and Westcot, 1985; SWRCB, 1987.)

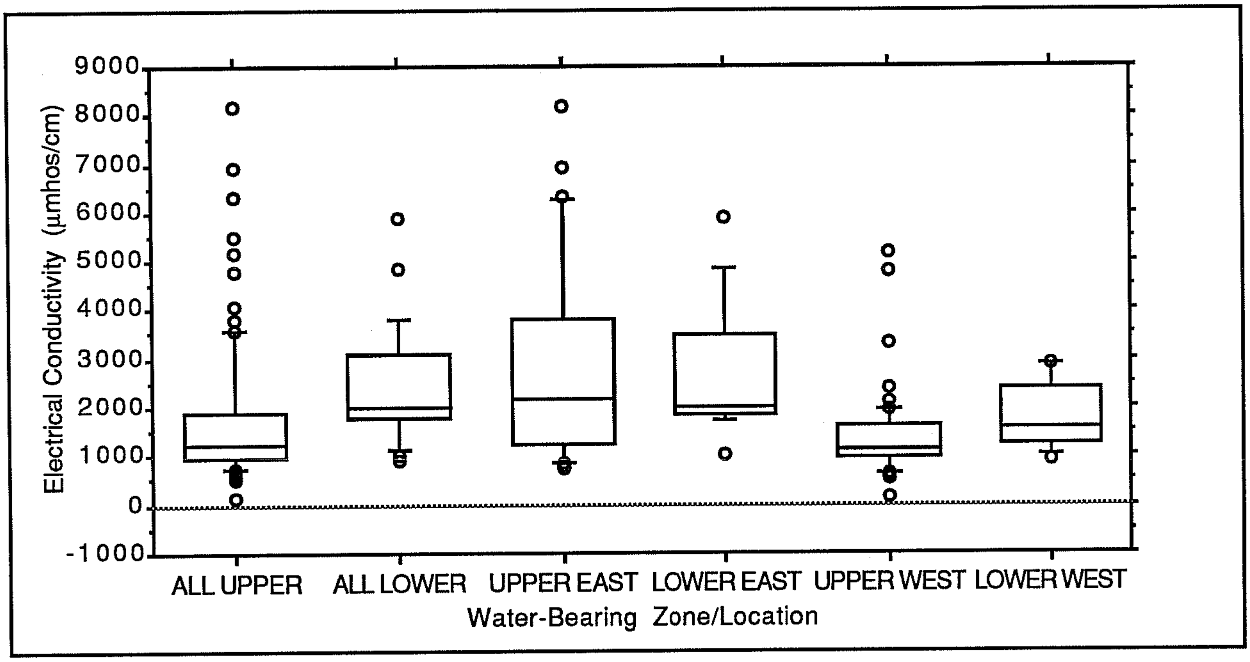
Table 3. Electrical Conductivity of water from selected wells presently being put to beneficial use within the study area.

LOCATION	AQUIFER ZONE*	NO. SAMPLES	MEDIAN EC -µmhos/cm-	RANGE EC
ENTIRE STUDY AREA	UPPER	96	1255	153 - 8200
ENTIRE STUDY AREA	LOWER	23	2000	934 - 5905
EAST OF SANTA FE GRADE	UPPER	26	2160	738 - 8200
EAST OF SANTA FE GRADE	LOWER	15	2030	996 - 5905
WEST OF SANTA FE GRADE	UPPER	70	1147	153 - 5180
WEST OF SANTA FE GRADE	LOWER	8	1595	934 - 2900

* Aquifer Zone = Water bearing zone in which the well is completed (Above or below the Corcoran Clay). Composite wells which draw from both zones are not included.

The number of wells being beneficially used in each zone east and west of the Santa Fe Grade suggests a lower quality in the upper zone in the east; to the west of the grade, only 10 percent of the users found it necessary to drill to the lower zone to find adequate and acceptable water, while to the east 37 percent of the wells are in the lower zone. Median salinity levels in the sampled wells show a difference between the upper and lower zone over the entire study area. However, the difference is less prominent when the areas east and west of the Santa Fe Grade are considered separately. The range of values for EC for wells drawing water from the upper and lower water-bearing zones are shown in Figure 5.

The Mann-Whitney U test was used to statistically evaluate salinity concentrations in the upper and lower zones for those wells which were currently being beneficially used. The data show no significant difference in salinity between the upper and lower water-bearing zone east or west of the Santa Fe Grade for those wells which were currently being beneficially used. An evaluation of the data for the entire study area shows the lower aquifer to be slightly more saline than the upper aquifer for the wells sampled. Statistical analysis shows that the ground water pumped from these two water bearing zones for beneficial use is very similar. The results of this study confirm recent studies by USGS and Department of Water Resources which found that the water quality of the upper and lower water-bearing zones in these areas is very similar.



EXPLANATION

o Extreme values.

☐ Box area represents middle 50 percent of values. Lines extending from box represent the range of data excluding extreme values.

Figure 5. Ranges of values for electrical conductivity for wells drawing water from the upper and lower water-bearing zones over the entire study area, and east and west of the Santa Fe Grade.

Evidence submitted during the hearings for SWRCB Order WQ 87-3 showed salinity levels from shallow ground water wells in the vicinity of Kesterson Reservoir to average about 4,000 mg/l. The network of wells sampled during this beneficial use survey was not sufficient to confirm the existence of this shallow poorer quality water. There is no evidence, however, that this poorer quality water in the vicinity of the reservoir is representative of the upper aquifer quality or water being drawn for beneficial use. The data base used for the average background ground water quality for the WQ 87-3 hearings was taken from March 1984 through November 1985 measurements of three domestic wells and two tile drain sumps within six miles of Kesterson Reservoir. This background water quality calculation was derived from a limited set of observations which included tile drain water. This tile drain water has a much higher total dissolved solids concentration than upper-zone water which is used for beneficial purposes. Water quality sampling shows that water developed for beneficial use within this upper water-bearing zone does show that salinity levels in areas east of the Santa Fe Grade are higher than those immediately to the west (Table 3). However, the levels are much lower than those reported in the hearings. The values reported in the hearings do not represent background water quality which is extracted for beneficial use from the upper water-bearing zone in the study area. In addition, there is no new evidence which suggests that this poorer quality water that is commonly found near the top of the ground water is hydrologically isolated from the main upper water-bearing zone.

MINERAL QUALITY

The mineral quality of 82 wells is reported in Appendix D. Piper trilinear diagrams were evaluated to illustrate differences in composition of water being extracted from the upper and lower aquifers throughout the entire study area. The Piper diagrams show the relative contributions of major cations and anions to the total ion content of the water. Separate Piper diagrams were also done for the wells east and west of the Santa Fe Grade. In the lower water-bearing zone sodium was consistently the dominant cation and chloride the dominant anion. This composition was consistent both for wells extracting water east and west of the Santa Fe Grade. Water being extracted from the upper zone did not show a predominant cation or anion character. This was particularly true west of the Santa Fe Grade. The mixed character of this upper zone may reflect the recent history of recharge by a variety of pumped and imported water. A general summary of the trilinear diagram analysis is presented in Table 4 and the diagrams are shown in Figures 6 through 8. Figure 9 shows the relationship of EC to chloride for water being extracted from the upper and lower water zones. A well defined relationship between these parameters exists in both zones; chloride concentrations increase with increasing EC.

TRACE ELEMENTS

The Environmental Impact Statement for the Kesterson Cleanup Program and SWRCB Order WQ 87-3 concluded that high trace element levels in the upper water-bearing zone limited beneficial uses of the ground water. As part of the beneficial use survey, a trace element survey was conducted on 89 representative wells throughout the ground water use area. The data from these wells is presented in Appendix E. The data show that trace elements in water extracted from both the upper and lower zones do not pose a major limitation to the beneficial uses of ground water within this study area.

Table 4. RELATIVE CONTRIBUTIONS OF MAJOR CATIONS AND ANIONS TO THE TOTAL ION CONTENT OF WATER BEING EXTRACTED FROM WELLS IN THE STUDY AREA.

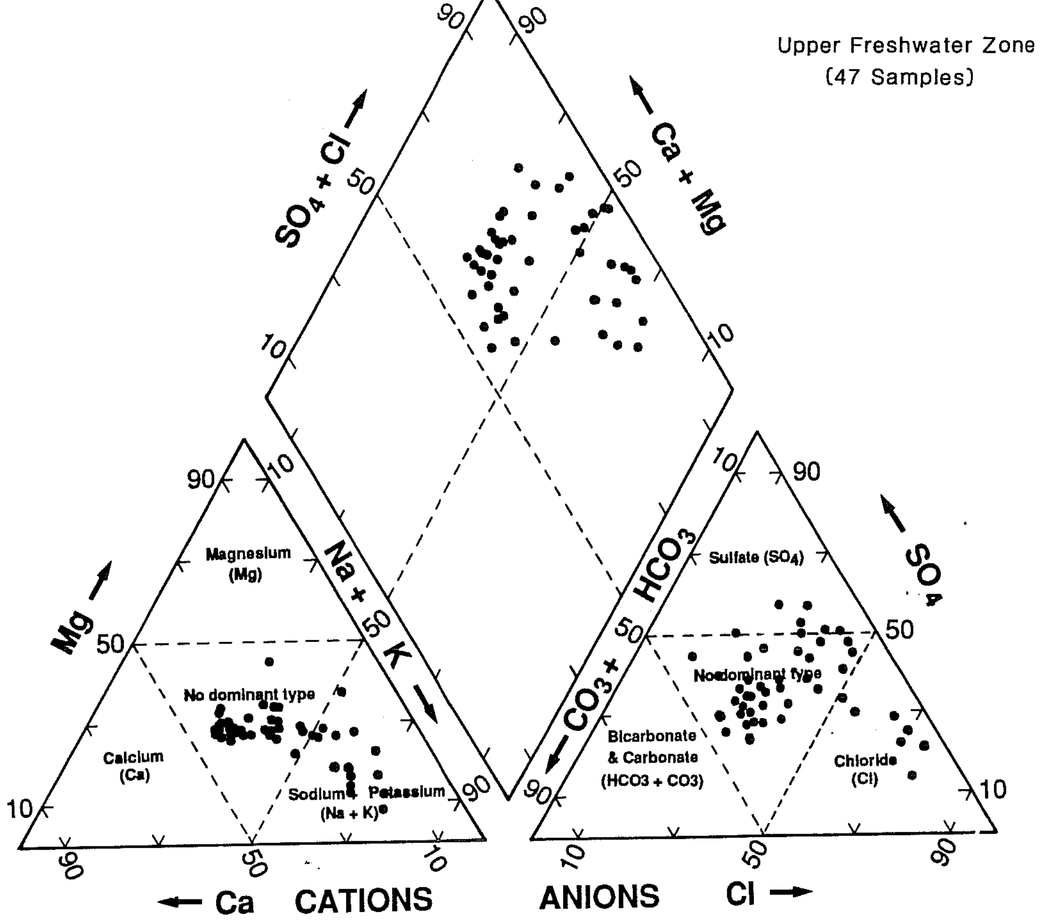
UPPER WATER BEARING ZONE (WELLS COMPLETED ABOVE CORCORAN CLAY)

LOCATION	CATIONS				ANIONS			
	% Ca	% Mg Dominant	% Na + K Dominant	% No Dominant Type	% HCO3+CO3 Dominant	% Cl Dominant	% SO4 Dominant	% No Dominant Type
EAST OF SANTA FE GRADE	0	0	52	48	0	24	20	56
WEST OF SANTA FE GRADE	0	0	9	91	0	5	9	86
TOTAL SAMPLES	0	0	32	68	0	15	15	70

LOWER WATER BEARING ZONE (WELLS COMPLETED BELOW CORCORAN CLAY)

LOCATION	CATIONS				ANIONS			
	% Ca	% Mg Dominant	% Na + K Dominant	% No Dominant Type	% HCO3+CO3 Dominant	% Cl Dominant	% SO4 Dominant	% No Dominant Type
EAST OF SANTA FE GRADE	0	0	86	14	0	36	21	43
WEST OF SANTA FE GRADE	0	0	86	14	0	86	0	14
TOTAL SAMPLES	0	0	86	14	0	52	14	33

Composite wells were excluded from this analysis.



Percentage of Total Milliequivalents Per Liter

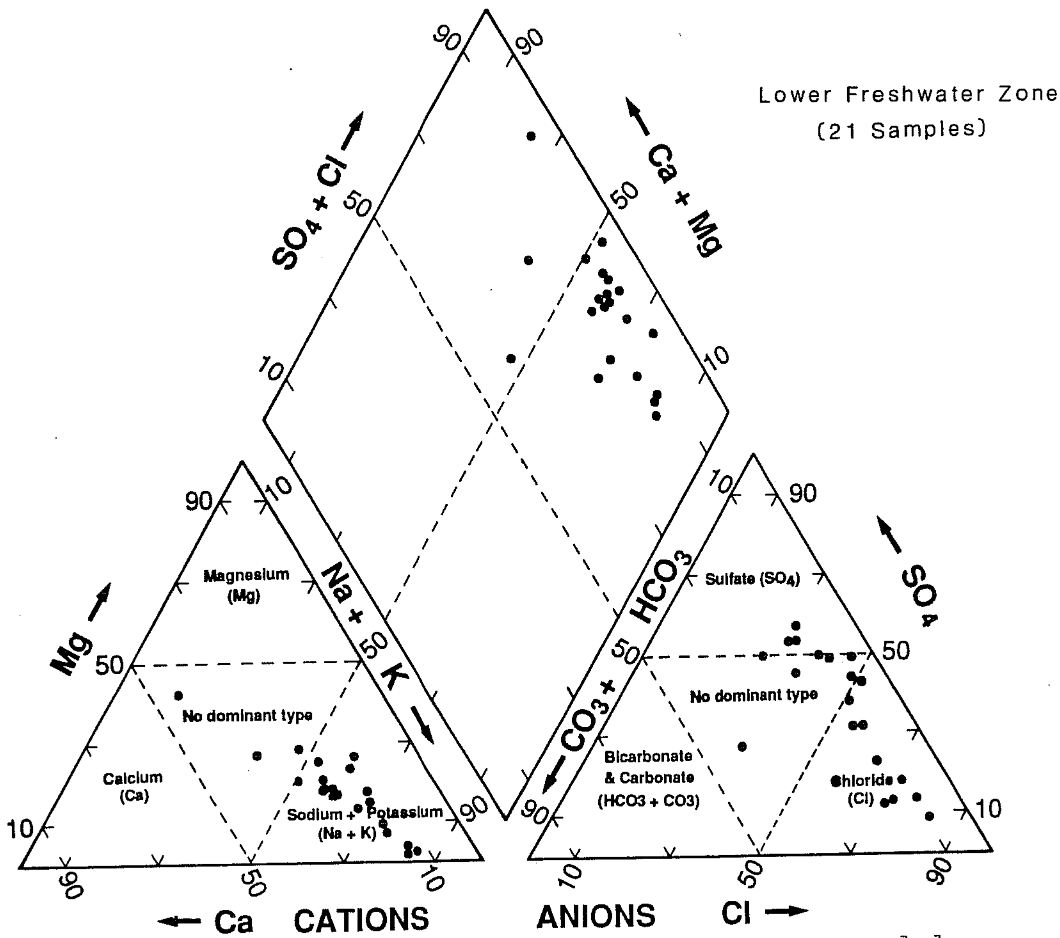


Figure 6. Chemical composition of water from the upper and lower zones for wells in the entire study area.

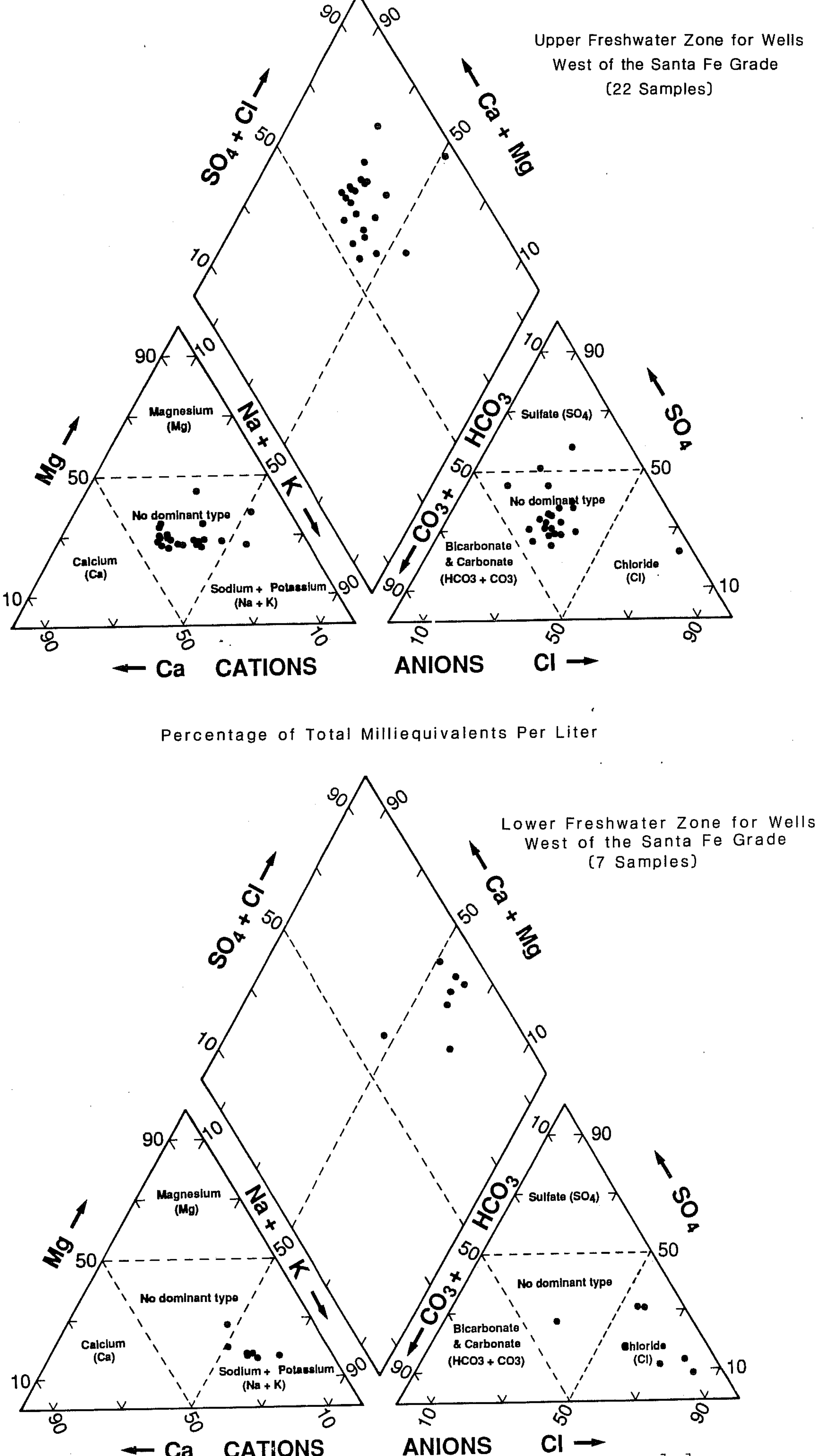


Figure 7. Chemical composition of water from the upper and lower zones for wells west of the Santa Fe Grade.

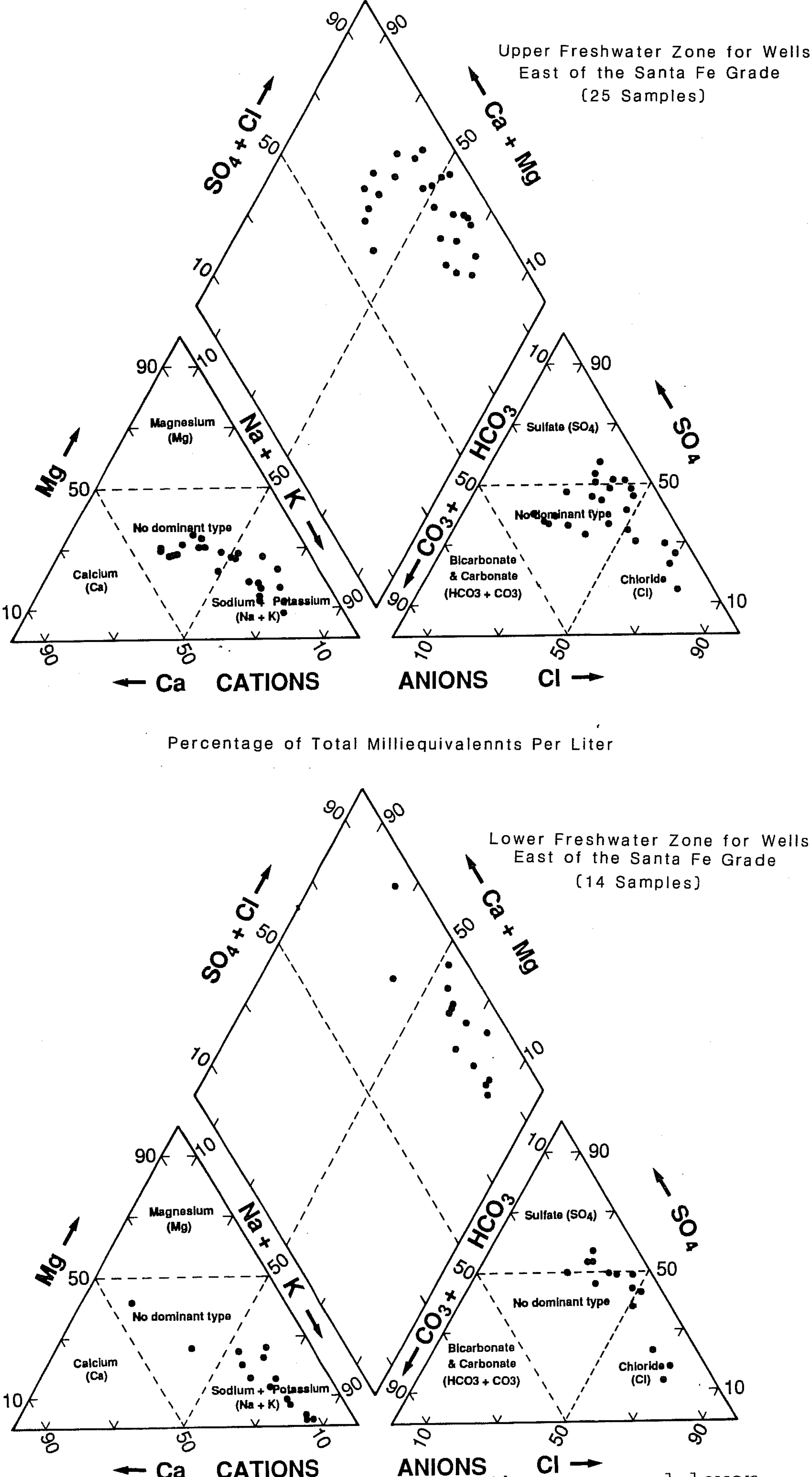


Figure 8. Chemical composition of water from the upper and lower zones for wells east of the Santa Fe Grade.

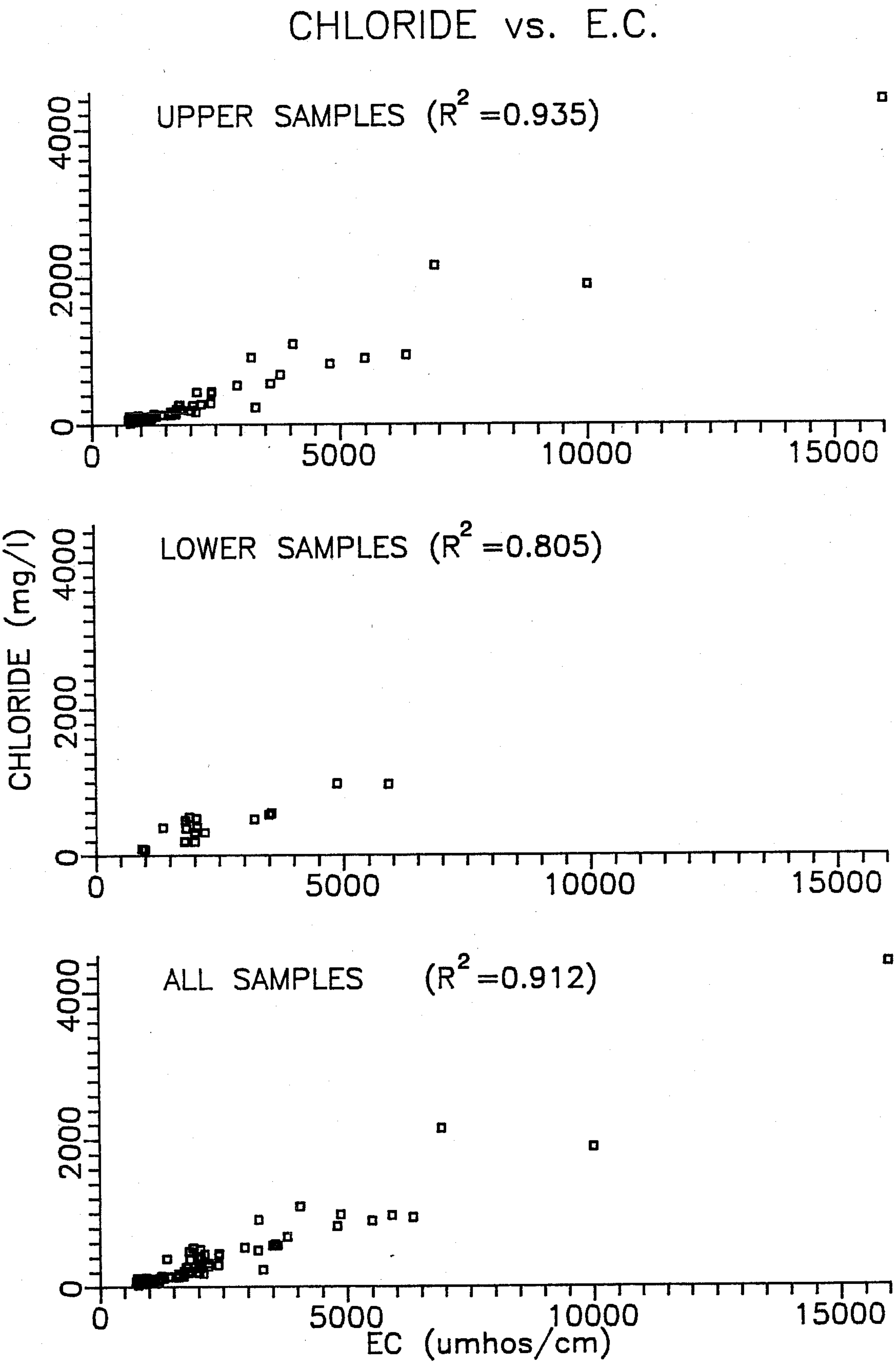


Figure 9. Chloride vs. electrical conductivity.

Only four wells of the 89 tested exceed established safe levels for their present beneficial uses. In most of these cases the trace element that exceeded safe levels was for only one of seven trace elements analyzed (copper, chromium, lead, molybdenum, nickel, selenium, and zinc). The trace elements that exceed existing water quality criteria are: Copper exceeding the drinking water criteria was found at 1400 mg/l in the city's domestic well (8S/9E-10G) at the Gustine Sewage Treatment Plant; zinc at 60 ug/l exceeded the drinking water criteria in a domestic well (8S/10E-30E2); and chromium at 70 ug/l in water from an irrigation well (7S/9E-27Q) exceeded the irrigation use criteria. Molybdenum exceeding the current irrigation water criteria of 10 ug/l was found in 11 irrigation wells. However, a recent review of this criteria recommends a 50 ug/l level for irrigation in the western San Joaquin Valley. Only one irrigation well (8S/10E-28E) with molybdenum at 70 ug/l exceeded this new recommendation.

Selenium levels were low throughout the study area. The range of values were 0.2 to 4.6 ug/l. There were no wells sampled which exceeded the 10 ug/l drinking water standard. The selenium criterion for the protection of aquatic life is currently under review. The present policy of the USFWS is to not apply water to wildlife habitat which is over 2 ug/l selenium. There was only one well being used for wildlife habitat which exceeded the 2 ug/l level. This well (7S/9E-27Q), completed in the upper zone, measured only 2.7 ug/l selenium. The highest selenium levels from wells within the study area were found in the northwestern corner; between the Santa Fe Grade and the Newman Wasteway. This area is upgradient of Kesterson Reservoir.

BORON

Elevated boron (>0.7 mg/l) commonly causes a toxicity problem in house plants, landscaping, and agricultural crops. The severity increases until most all plants, except those with a high tolerance, show effects at levels in excess of 3 mg/l. Boron data for wells in the study area are given in Table 5. Of the wells tested boron is elevated in over 60 percent of these. Of the 23 wells used for irrigation in the study area, only three had boron values below 0.7 mg/l. Two of the irrigation wells (7S/9E-22P and 8S/10E-28E) which take water from the upper zone had a boron concentration greater than 3 mg/l. In addition, two irrigation wells (8S/9E-24A3 and 8S/10E-29A) taking water from the lower zone exceeded the 3 mg/l level.

Table 5. BORON CONCENTRATIONS IN WELL WATER SAMPLES TAKEN IN THE STUDY AREA.

LOCATION	AQUIFER ZONE*	NO. SAMPLES	MEDIAN B - mg/l -	RANGE B - mg/l -
ENTIRE STUDY AREA	UPPER	50	0.6	0.2 - 7.0
ENTIRE STUDY AREA	LOWER	23	2.5	0.4 - 4.6
EAST OF SANTA FE GRADE	UPPER	26	1.2	0.2 - 7.0
EAST OF SANTA FE GRADE	LOWER	17	2.8	0.4 - 4.6
WEST OF SANTA FE GRADE	UPPER	25	0.4	0.3 - 1.3
WEST OF SANTA FE GRADE	LOWER	6	1.9	0.9 - 2.2

* Aquifer Zone = Water bearing zone in which the well is completed
(Above or below the Corcoran Clay).
Composite wells which draw from both zones are not included.

Median boron concentrations for wells east of the Santa Fe Grade were higher than those to the west in both the upper and lower water-bearing zones. The Mann-Whitney U statistical test showed there is a significant difference between the boron concentrations in water samples taken from the upper and lower water-bearing zones with boron levels being higher in samples from the lower water-bearing zone.

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A P P E N D I X   A

ACTIVE WELLS

Codes for Tables in Appendix A

S

●	Wells sampled for water quality.
◊	Electrical conductivity measurements only.

WATER USE

D	Domestic.
D*	Domestic, but bottled water used for drinking.
M	Municipal.
S	Stock Watering.
I	Irrigation.
P	Process.
W	Wildlife Habitat.

ACTIVE WELLS

STATE WELL NO.	S	USGS 7.5' QUAD	AQ/WELL DEPTH-ft	WATER USE	LOCATION
7S/9E-15M		GUSTINE	L/524	I,S	.5 MI SE/NEWMANSTP,.25MI SE/NEWMAN WW
7S/9E-16J1	•	GUSTINE		I,S	100' S/NEWMAN WW, 1.4 MI NE/SANTA FE GRADE
7S/9E-16J2	•	GUSTINE	L/430	I,S	125' S/NEWMAN WW, 1.5 MI NE/SANTA FE GRADE
7S/9E-21C	•	GUSTINE		I,S	100' S./NEWMAN WW, I MI NE/SANTA FE GRADE
7S/9E-21N	•	GUSTINE	U	D,S	.1 MI E/SANTA FE GRADE RD., .1 MI S/NEWMAN WW
7S/9E-22P	•	GUSTINE	U	I,S,W	1MI. N. NEWMAN GC/P PUMP
7S/9E-23N	•	GUSTINE	U/45	S,W	PUMP 22, W/NEWMAN GUN CLUB RD @ MUD SLOUGH
7S/9E-27P	•	GUSTINE	U	D	1.35 MI S./NEWMAN WW, .5 MI E./SANTA FE GR.
7S/9E-27N	•	GUSTINE	L/450	I	.3 MI E/SANTA FE GR, 10'N/NEWMAN GC RD
7S/9E-27Q	•	GUSTINE	U	I,W	.75 MI E./SANTA FE GR, .15 MI S. NEWMAN GC RD
7S/9E-28E	◊	GUSTINE	U/190	D	785 SANTA FE GRADE RD, NEWMAN
7S/9E-28F1	•	GUSTINE	U/120	D	E. SIDE SANTA FE GRADE RD, .5 MI S/NEWMAN WW
7S/9E-28F2	•	GUSTINE	U/180	D,S	785 SANTA FE GRADE, WELL @ DAIRY BARN
7S/9E-28G	•	GUSTINE	U/114	D,S	.1 MI E/SANTA FE GR, .75 MI S NEWMAN WW, @WM
7S/9E-28J	•	GUSTINE	U/25	D,S	100'E/SANTA FE GR, 1.2 MI S NEWMAN WW,BV PK
7S/9E-28K	•	GUSTINE	U/86	D,S	E. SANTA FE GR, 1MI S/NEWMAN WW, .1MI N BV PK
7S/9E-28L	◊	GUSTINE	U/153	D,S	.35 MI N/PRESTON RD,.4 MI W/SANTA FE GRADE
7S/9E-28R	•	GUSTINE	U/188	D,P	E. SIDE SANTA FE GR., S/BV PARK, AVIL.MT.
7S/9E-28R2	◊	GUSTINE		D,S	27225 PRESTON RD, NEWMAN
7S/9E-29Q		GUSTINE		D	50' N/PRESTON RD,.3 MI E/CANAL SCHOOL RD
7S/9E-29R2	•	GUSTINE	U/153	D,S	28024 PRESTON RD/N OF END HUNT RD.
7S/9E-29R4	◊	GUSTINE	U/146	D	28216 W. PRESTON RD, NEWMAN
7S/9E-32A1	◊	GUSTINE		D,S	28225 W. PRESTON RD, NEWMAN
7S/9E-32A2	◊	GUSTINE	U/150	D,S	145 S. HUNT RD., NEWMAN
7S/9E-32B2	◊	GUSTINE	U/137	D	28315 W. PRESTON RD, NEWMAN
7S/9E-32C1		NEWMAN		D	28135 PRESTON RD, NEWMAN
7S/9E-32C2	◊	NEWMAN	U/210	D	60 CANAL SCHOOL RD, NEWMAN
7S/9E-32G4	◊	GUSTINE		D,S	.4 MI S/PRESTON RD,.3 MI W/HUNT RD
7S/9E-32G1	•	NEWMAN	U/137	I	GDD 11/.5MI S/PRESTON RD
7S/9E-32G2	•	NEWMAN	U	D	28391 PRESTON RD, .5 MI S/PRESTON RD
7S/9E-32G3		NEWMAN		D	28391 PRESTON RD, NEWMAN
7S/9E-32H2	◊	GUSTINE		D	323 S. HUNT RD, GUSTINE
7S/9E-32H3	◊	GUSTINE		D,S	617 S. HUNT RD, GUSTINE
7S/9E-32J	◊	GUSTINE		D	491 S. HUNT RD, GUSTINE
7S/9E-32L1		GUSTINE	U	I	GDD 27 CANAL SCHOOL AT NETHERTON RD
7S/9E-32P2		NEWMAN		I	100' E/CANAL SCH RD, .1 MI N/BAUMBAUER RD
7S/9E-32Q3	•	NEWMAN	U	D	250' N/BAUMBAUER RD,.2MI E CANAL SCHOOL RD
7S/9E-32Q1	◊	GUSTINE	U/140	D,S	28284 BAUMBAUER RD, NEWMAN
7S/9E-32Q2		GUSTINE	U/160	D,S	28284 BAUMBAUER RD, NEWMAN
7S/9E-32R	◊	GUSTINE		D,S	857 S. HUNT RD, GUSTINE
7S/9E-33C1	◊	GUSTINE	U/110	D,S	2265 W. PRESTON RD, NEWMAN
7S/9E-33C2	◊	GUSTINE	U/160	D	2265 W. PRESTON RD, NEWMAN
7S/9E-33D1	◊	GUSTINE	U/155	D	46 S. HUNT RD, NEWMAN
7S/9E-33D2	◊	GUSTINE	U/146	D	140 S. HUNT RD., NEWMAN
7S/9E-33D3	◊	GUSTINE	U/90	D	226 S. HUNT RD., NEWMAN
7S/9E-33E3		GUSTINE		D,S	264 S. HUNT RD., NEWMAN
7S/9E-33E4	◊	GUSTINE		D	294 S. HUNT RD., NEWMAN

ACTIVE WELLS

STATE WELL NO.	S	USGS 7.5' QUAD	AQ/WELL DEPTH-ft	WATER USE	LOCATION
7S/9E-33E5	◊	GUSTINE	U/80	D	416 S. HUNT RD., NEWMAN, 25' NE/HOUSE
7S/9E-33F2	•	GUSTINE	U/80	D	490 S. HUNT RD/.4 MI E/HUNT
7S/9E-33P1	◊	GUSTINE	U/156	D,S	990 KNIEBES RD, GUSTINE, IST HOUSE
7S/9E-33P2		GUSTINE	L/350	D,S	990 KNIEBES RD, GUSTINE, DAIRY BARN
7S/9E-33P3		GUSTINE	U/75	D,S	990 KNIEBES RD, GUSTINE, HOUSE BEHIND BARN
7S/9E-33N1		GUSTINE	U/210	D,S	786 S. HUNT RD, GUSTINE
7S/9E-33N2		GUSTINE	U/140	D	990 S. HUNT RD, GUSTINE
7S/9E-34Q	•	GUSTINE	L/670	D,S,W	.4 MI N/HWY 140, E. SIDE SANTA FE GRADE
7S/9E-35M	•	GUSTINE	L/580	D,I	.15 MI N/HWY 140, 300' E. LOS BANOS CREEK
7S/9E-35N		GUSTINE	L/400	I	200' S/HWY 140 @ SHED, LOS BANOS CREEK
7S/10E-35E		STEVINSON	156-184	S,I	.25 MI E/LANDER AVE, 2.25 MI S/HWY 140
7S/10E-35N		STEVINSON	156-184	S,I	.2 MI E/LANDER AVE, 2.3 MI S/HWY140
7S/10E-35P		STEVINSON	156-184	S,I	.5 MI E/LANDER AVE, 2.3 MI S/HWY 140
8S/9E-2N	•	GUSTINE	L/630	I,S,W	E. SIDE SANTA FE GR., .75 MI S. OF HWY 140
8S/9E-2P2	•	GUSTINE	L/675	D	.85 MI S.OF HWY 140, E. SIDE SANTA FE GR.
8S/9E-3C	•	GUSTINE	L/470	D,S	.5MI N/HWY 140, .3MI W/SANTA FE GRADE
8S/9E-3M1		GUSTINE	L/682	I	.5 MI N/HWY140, .5 MI E/KNIEBES RD, GUSTINE
8S/9E-3N1		GUSTINE	U/100	I	27056 W. HWY 140, GUSTINE
8S/9E-3N2	◊	GUSTINE	U/200	D	27056 W. HWY 140, GUSTINE
8S/9E-3P1	◊	GUSTINE		D	26468 W. HWY 140, GUSTINE, 200' W/HOUSE
8S/9E-3P2		GUSTINE	L/285	I	26468 W. HWY 140, GUSTINE, .2 MI N/HOUSE
8S/9E-3Q	•	GUSTINE	U	M	GUSTINE AIRPORT, HWY 140
8S/9E-4B2	•	GUSTINE	U/83	D	1130 S. KNIEBES RD, E/RD,S/ANDERSON RD
8S/9E-4F	•	GUSTINE	U/250	D	1299 KNIEBES RD/100' W/RD,N/CANAL
8S/9E-4G1	◊	GUSTINE	U/140	D	E/SIDE KNIEBES RD, .25 MI S/ANDERSON RD.
8S/9E-4K1	◊	GUSTINE	U/130	D,S	.4 MI N/HWY 140, E SIDE KNIEBES RD, @ DAIRY
8S/9E-4K2	◊	GUSTINE		D,S	.4 MI N/HWY 140, E SIDE KNIEBES RD, @ DAIRY
8S/9E-4L	◊	GUSTINE		D,S	.4 MI N/HWY 140, W SIDE KNIEBES RD
8S/9E-4N	◊	GUSTINE		D	1760 S. HUNT RD, GUSTINE
8S/9E-4P	◊	GUSTINE		D	27660 HWY 140, GUSTINE
8S/9E-4Q	◊	GUSTINE	U/98	D,S	27484 HWY 140, GUSTINE
8S/9E-4R	◊	GUSTINE	U/190	D	27240 HWY 140, GUSTINE
8S/9E-5A2	◊	GUSTINE	U/140	D	1031 S. HUNT RD, GUSTINE
8S/9E-5A1		GUSTINE		D	1ST HOUSE S/1031 S. HUNT RD, GUSTINE
8S/9E-5B1	•	GUSTINE	U/112	I	GDD 14/500' S/BAUMBAUER RD
8S/9E-5B2	◊	NEWMAN	U/97	D,P	28525 BAUMBAUER RD, 25' E/INGOMAR GRADE
8S/9E-5B3	◊	GUSTINE		D	8436 BAUMBAUER RD, .2 MI E/INGOMAR GRADE
8S/9E-5H1	•	GUSTINE	U/167	D,S	1369 S. HUNT RD, GUSTINE,W/SIDE RD BEFORE HOUSE
8S/9E-5H2	◊	GUSTINE	U/137	D,S	1369 S. HUNT RD, GUSTINE
8S/9E-5J3	◊	GUSTINE	U/147	D	1483 S. HUNT RD, GUSTINE
8S/9E-5J4	◊	GUSTINE	U/150	D	1461 S. HUNT RD, GUSTINE
8S/9E-5J5	◊	GUSTINE	U/165	D,S	1555 S. HUNT RD, GUSTINE
8S/9E-5R	◊	GUSTINE	U	D	1909 HUNT RD, GUSTINE, 300'NW HOUSE @WNDMLL
8S/9E-8D1	•	NEWMAN	U/120	M,P	GUSTINE CITY WELL 3, NORTH AVE & LAUREL AVE
8S/9E-8F1	•	NEWMAN	U/123	M,P	GUSTINE CITY WELL 2, ELM AVE & SOUTH AVE
8S/9E-8H3	•	GUSTINE	U/130	M,P	GUSTINE CITY WELL 1, SOUTH AVE
8S/9E-8N	•	HOWARD R	U/250	M,P	GUSTINE CITY WELL 4, HARRY P. SCHMIDT PARK

ACTIVE WELLS

STATE WELL NO.	S	USGS 7.5' QUAD	AQ/WELL DEPTH-ft	WATER USE	LOCATION
8S/9E-9A1	◊	GUSTINE	U/157	D	27105 W. HWY 140, GUSTINE
8S/9E-9A2	◊	GUSTINE	U/220	D	271511 W. HWY 140, GUSTINE
8S/9E-9B1	•	GUSTINE	U/180	D	2230 KNIEBES RD, IST HOUSE S/HWY 140, E SIDE
8S/9E-9B2	◊	GUSTINE		D	27239 W. HWY 140, GUSTINE
8S/9E-9C1	•	GUSTINE	U/75	D	2169 KNIEBES RD, IST HOUSE S HWY140, W SIDE
8S/9E-9C2		GUSTINE		D	27661 W. HWY 140, GUSTINE
8S/9E-9D	◊	GUSTINE	U/100	D	2096 S. HUNT RD, GUSTINE
8S/9E-9F1	•	GUSTINE	U/233	D,I	50' N/CARN. RD, S/GREENHOUSES
8S/9E-9F2	◊	GUSTINE	U/30	D	27692 CARNATION RD, GUSTINE
8S/9E-9F3		GUSTINE	U/170	D,I	27630 W. CARNATION RD, GUSTINE
8S/9E-9G	◊	GUSTINE	U/75	D,S	2388 KNIEBES RD, GUSTINE
8S/9E-9K3	•	GUSTINE	U	I	GDD 21 250' S/CARNATION RD, E/KNIEBES RD
8S/9E-9K1	◊	GUSTINE	U/82	D,S	27345 CARNATION RD, GUSTINE @ DAIRY
8S/9E-9K2		GUSTINE	U	D,S	27345 CARNATION RD, GUSITNE @ HOUSE
8S/9E-9M1	•	GUSTINE	L/496	D	330' S/CARNATION RD,75' W/HUNT RD
8S/9E-9M2	•	GUSTINE		D	INSIDE 2ND CARNATION BLDG S/CARN.RD @ HUNT
8S/9E-9M3	•	GUSTINE	U/90	D	27834 W. CARNATION, GUSTINE, BEHIND GARAGE
8S/9E-9N1	•	INGOMAR		D,S	150' E/INGOMAR GR, 2807 S. HUNT RD, GUSTINE
8S/9E-9N3	◊	INGOMAR		D	2840 HUNT RD, GUSTINE
8S/9E-9Q	◊	INGOMAR		D*,S	2848 KNIEBES RD, GUSTINE
8S/9E-10C1	◊	GUSTINE	U/80	D	26545 W. HWY 140, GUSTINE, INSIDE E. BLDG.
8S/9E-10C2	◊	GUSTINE	U/80	D	26545 W. HWY 140, GUSTINE,75' W/WEST CABIN
8S/9E-10D1	◊	GUSTINE	U/127	D	26885 W. HWY 140, GUSTINE
8S/9E-10D2	◊	GUSTINE	U/130	D	27029 W. HWY 140, GUSTINE
8S/9E-10D3	◊	GUSTINE		D	27057 W. HWY 140, GUSTINE
8S/9E-10E1	◊	GUSTINE		D	26954 CARNATION RD, GUSTINE
8S/9E-10E2	◊	GUSTINE		S	26954 CARNATION RD, GUSTINE, 75' E/HOUSE
8S/9E-10G	•	GUSTINE	U/150	M	GUSTINE STP, E/END CARNATION ROAD
8S/9E-10M	◊	GUSTINE		D,S,I	26867 CARNATION RD, GUSTINE
8S/9E-13B	•	INGOMAR	L/793	S,W	.5 MI E/SAN FE GR/.1 MI E/EAG DIT/.9 MI N/GCRD
8S/9E-14N		INGOMAR		S	1 MI W/GUSTINE GUN CL,GUN CLUB RD @ CORRAL
8S/9E-14RI	•	INGOMAR	U/213	D	50' N/GUN CLUB RD., .4 MI W. SANTA FE GR.
8S/9E-15P		INGOMAR		D*	N. SIDE GUN CL RD, 1.2 MI E/INGOMAR GRADE
8S/9E-16D	◊	INGOMAR	U/150	D,S	3196 S. HUNT RD, GUSTINE
8S/9E-16F	•	INGOMAR	U/25	D*	.15 MI E/INGOMAR GR, 3384 S. HUNT RD, GUSTINE
8S/9E-16G2		INGOMAR	U	S	S. END KNIEBES RD
8S/9E-16P2	•	INGOMAR	U/100	D,S	.1 MI N/GUN CLUB RD, 27506 GUN CLUB RD,GUSTINE
8S/9E-16Q1	◊	INGOMAR		D,S	27272 W. GUN CLUB RD, GUSTINE
8S/9E-16Q2	•	INGOMAR	U	D	.2 MI N/GUN CLUB RD, .3 MI E INGOMAR GR
8S/9E-21A2	◊	INGOMAR	U/90	D	27435 W. GUN CLUB RD, GUSTINE
8S/9E-21B1	•	INGOMAR	U/216	D,S	200' S/RD:27272 GUN CLUB RD @DAIRY BARN
8S/9E-21B2		INGOMAR		D,S	27435 W. GUN CLUB RD, GUSTINE
8S/9E-21H2		INGOMAR	U	D,S	.25 MI W/AZEVEDO RD, .4 MI S/GUN CLUB RD
8S/9E-21K		INGOMAR	U/124	I	100' E/INGOMAR GR, .3 MI W/TAGLIO
8S/9E-21R2	•	INGOMAR	U/125	S	25' N/TAGLIO RD, .1 MI E/INGOMAR GRADE
8S/9E-22M2	◊	INGOMAR		S	E. SIDE AZEVEDO, .3 MI W/TAGLIO @ RED BARN
8S/9E-22N2		INGOMAR		I,S	.05 MI N/TAGLIO RD, E SIDE AZEVEDO RD

ACTIVE WELLS

STATE WELL NO.	S	USGS 7.5' QUAD	AQ/WELL DEPTH-ft	WATER USE	LOCATION
8S/9E-24A3	•	INGOMAR	L/450	D,S,I	.1 MI S. OF GUN CLUB RD., .4 MI E. OF SANTA FE GR.
8S/9E-27G		INGOMAR	U/175	D,S	E END PFITZER RD, E/N END OF MOFFAT RD, E/PONDS
8S/9E-27L		INGOMAR	U/116	S	.25 MI S/ PFITZER RD, 25' W/MOFFAT RD
8S/9E-27P	•	INGOMAR	U/44	S	25' W/MOFFAT RD, .3 MI S/PFITZER
8S/9E-27Q		INGOMAR		I	.3 MI S/PFITZER RD, 10'E/MOFFAT RD
8S/9E-34G		INGOMAR		I	.6 MI N/COTTONWOOD RD, E. MOFFAT RD
8S/9E-34H		INGOMAR	L/480	D	.45 MI N/COTTONWOOD/.5 MI E/MOFFAT
8S/9E-34K1		INGOMAR	L/473	I	.45 MI N/COTTONWOOD, 10' E/MOFFAT RD
8S/9E-34K2		INGOMAR	L/480	I	.3 MI N/COTTONWOOD, 25' E/MOFFAT RD, N/FENCE
8S/9E-34Q1	•	INGOMAR	U/188	D,S	100' E./MOFFAT RD. AT E. END COTTONWOOD RD.
8S/9E-34Q2	•	INGOMAR	L/440	D,S	150' E./MOFFAT RD. AT E. END COTTONWOOD RD.
8S/10E-2J		STEVINSON	U/184	S,I	1 MI E/LANDER AVE, 3.25 MI S/HWY 140
8S/10E-2P		STEVINSON	156-184	S,I	.4 MI E/ LANDER AVE, 3.75 MI S/HWY 140
8S/10E-2R		STEVINSON	C/276	S,I	1.1 MI E/LANDER AVE, 3.75 MI S/HWY 140
8S/10E-3J		STEVINSON	U/188	S,I	25' E/LANDER AVE, 4.25 MI S/HWY 140
8S/10E-9P		INGOMAR	U/125	S,I	E/SAN LUIS DRAIN, 1.25 MI N/GUN CLUB RD
8S/10E-11E		STEVINSON	156-184	S,I	.4 MI E/LANDER AVE, 4.25 MI S/HWY 140
8S/10E-16N		INGOMAR		I,W	KESTERSON NWR/BOR KR-86
8S/10E-16Q2	•	SAN LUIS	C/295	D,I,S	EAST END GUN CLUB RD., FAUCET EAST/HORSE BARN
8S/10E-18N1	•	INGOMAR	U/60	D	.8 MI E/SANTA FE GR, N. SIDE GUN CLUB RD
8S/10E-19A1	•	INGOMAR	U/90	D *	50' S/GUN CLUB RD, 100' E/SANTA FE CANAL
8S/10E-20Q1		INGOMAR		W	.8 MI S/GUN CLUB RD,AT RED TRAILER
8S/10E-20Q2	•	INGOMAR	U/60	D	.8 MI S/GUN CLUB RD @ MUD SL, .5 MI SW/KEST P3
8S/10E-21P1	•	INGOMAR	L/730	D,W	200' E/FREMONT CANAL, .5 MI S/KESTERSON RES.
8S/10E-22L2		SAN LUIS	U/154	S,I	.75 MI S/GUN CLUB RD, 200' E SAN LUIS DRAIN
8S/10E-28B	•	INGOMAR	L/700	D,W	200' E/FREMONT CANAL, .5 MI S/KESTERSON RESER
8S/10E-28E	•	INGOMAR	U/70	D*,I	1.4 MI S/GUN CL RD @FREMONT CANAL
8S/10E-29A	•	INGOMAR	L/370	D,I	1 MI S/GUN CLUB RD @ MUD SLOUGH
8S/10E-29B	•	INGOMAR	U/80	W	1.25 MI S/GUN CLUB RD @ MUD SLOUGH
8S/10E-29D		INGOMAR	L/640	I,W	1.2 MI S/GUN CLUB RD, 50' E/SANTA FE CANAL
8S/10E-30E2	•	INGOMAR	U/83	D*,W	W. SIDE SANTA FE GR.1.5 MI S. OF GUN CLUB RD.
8S/10E-35F2	•	SAN LUIS	L	D	W. SIDE LANDER AVE. , 3.75 MI N OF WOLFSEN RD.
8S/10E-35Q1	•	SAN LUIS	U/27	S	100' W/CORRAL RD,3 MI N/MER SPR RD -WINDMILL
8S/10E-35Q2	•	SAN LUIS	U/38	D *	50' W/CORRAL RD, 3.1 MI N/MER SPR RD
9S/9E-1K	•	INGOMAR	U/25	D *	2 MI E/INGOMAR GR, .75 MI S INGOMAR GR RD
9S/9E-2A	•	INGOMAR	L/445	D	l.6 MI E/INGOMAR GR ON INGOMAR GR. RD.
9S/9E-2L1	•	INGOMAR	L/500	I,S	.8 MI E/INGOMAR GRADE, .25 MI S/INGOMAR GR RD.
9S/9E-2G1		INGOMAR	L/352	I,S	1 MI E/INGOMAR RANCH, .25 MI W/SALINAS CLUB
9S/9E-3C1	•	INGOMAR	L/490	S,I	25' S/COTTONWOOD RD @ INGOMAR GRADE
9S/9E-3G	•	INGOMAR	L/409	D,I,S	.25 MI E/INGOMAR GRADE AT INGOMAR RANCH
9S/9E-3R1	•	INGOMAR	L/350	I,S	.15 MI E/INGOMAR GRADE, .55 MI S/INGOMAR GR RD
9S/9E-13F1		INGOMAR	L/560	I,S	1.25 MI E/ING GR, 1.75 MI W/RUBINO DITCH
9S/9E-11C1		INGOMAR		I,S	1.5 MI E/ SPRR, 1 MI S/SALINAS CLUB
9S/9E-14P1	•	INGOMAR		D	50' E/INGOMAR GRADE @ HEARST RD
9S/9E-14P2	•	INGOMAR		I	100' E/INGOMAR GRADE, .2 MI N/HEARST RD
9S/9E-14Q	•	INGOMAR		D,S	.2 MI E/INGOMAR GR, 25471 HEARST RD
9S/10E-2R	•	SAN LUIS		D *	200' W/CORRAL RD., 2 MI N /MERCEY SPR RD

ACTIVE WELLS

STATE WELL NO.	S	USGS 7.5' QUAD	AQ/WELL DEPTH-ft	WATER USE	LOCATION
9S/10E-5Q	•	INGOMAR	U/165	D,I	E. SIDE SANTA FE GR., 1 MI N OF PATMAN GR.
9S/10E-6F		INGOMAR	U/65	D	3 MI E/INGOMAR GR, S/INGOMAR RD @MAR CLUB
9S/10E-6H	•	INGOMAR	L/633	D,W	1.75 MI E/SALINAS CL @INGOMAR GR RD
9S/10E-8B	•	INGOMAR	U/175	D *	W. SIDE SANTA FE GR., .75 MI N. OF PATMAN GR.
9S/10E-8J	•	INGOMAR	L/514	D*,S	W. SIDE SANTA FE GR. AT PATMAN GRADE
9S/10E-9R1	•	SAN LUIS	L/400	D,S	E./SANTA FE GR, I MI NE/SL SPILLWAY, W. OF SL CNL
9S/10E-10N	•	SAN LUIS	U/155	D,S	1.1 MI NE/SL SPILLWAY ALONG SL CANAL, E./SF GR
9S/10E-12N	•	SAN LUIS	U/160	D,I	100' W/CORRAL RD, .9MI N/ MERCEY SPR RD
9S/10E-16L	•	INGOMAR	U/230	D *	W. SIDE SANTA FE GRADE, 1 MI S./PATMAN GRADE
9S/10E-16R	•	SAN LUIS	U/222	D,S	E. SIDE SANTA FE GR. RD. @SAN LU SPILLWAY DITCH
9S/11E-6H	•	SAN LUIS		D	N. END WOLFSEN RD., SAN LUIS NWR SHOP
9S/11E-7N1	•	SAN LUIS	L/420	D,I,S	SAN LUIS RANCH, 200' NW/WOLFSEN RD.
TS @ 7S/9E-28B1	•	GUSTINE	U/<10'	TILE DRAIN	8" TILE DRAIN .4MI E SAN FE GR/.8 MI S/NEW WW
TS @ 7S/9E-28B2	•	GUSTINE	U/<10'	TILE DRAIN	6" TILE DRAIN .4 MI E SAN FE GR/.8 MI S/NEW WW
TS @ 7S/9E-28Q	•	GUSTINE	U/<10'	TILE DRAIN	TILE SUMP W/BELLA VISTA PARK
TS @ 7S/9E-35F	•	GUSTINE	U/<10'	TILE DRAIN	50' N/HWY140, .55 MI S. MUD SLOUGH, N/KEST NWR
TS @ 8S/9E-04C	•	GUSTINE	U/<10'	TILE DRAIN	TILE SUMP AT ANDERSON & KNIEBES RD
TS @ 8S/9E-09A3		GUSTINE	U/<10'	TILE DRAIN	TILE SUMP ON SECTION LINE, .2 MI S/HWY 140
TS @ 8S/9E-09P	•	INGOMAR	U/<10'	TILE DRAIN	TILE SUMP W/KNIEBES RD, S/CARNATION RD
TS @ 8S/9E-15M	•	INGOMAR	U/<10'	TILE DRAIN	TILE DR .5 MI E/INGOMAR GR, .5 MI N/GUN CLUB RD
TS @ 8S/9E-34P	•	INGOMAR	U/<10'	TILE DRAIN	TILE DRAIN SUMP/INGOMAR GR & COTTONWOOD RD
TS @ 9S/11E-07F	•	SAN LUIS	U/<10'	TILE DRAIN	.5 MI N/WOLFSEN RD, .4 MI E/SALT SLOUGH

A P P E N D I X   B

ABANDONED WELLS

Codes for Tables in Appendix B.

FORMER USE

D	Domestic.
M	Municipal.
S	Stock Watering.
I	Irrigation.
W	Wildlife Habitat.
MONITOR	Monitoring Well.

ABANDONED WELLS

STATE WELL NO.	USGS 7.5' QUAD	FORMER USE	LOCATION
7S/9E-16J3	GUSTINE	S,I	125' S/NEWMAN WW, 1.5 MI NE/SANTA FE GR
7S/9E-26A	GUSTINE	S	.25 MI NW/HWY140, 1 MI SW SAN JOAQUIN RIVER
7S/9E-28F3	GUSTINE	D,S	250' W/SANTA FE GR/.5 MI S/NEWMAN WW
7S/9E-28N1	GUSTINE	D,S	25' N/PRESTON RD, .6 MI W/SANTA FE GRADE
7S/9E-29N1	GUSTINE	D	28216 W. PRESTON RD, NEWMAN
7S/9E-29N2	GUSTINE	D,S	28024 PRESTON RD, N OF END HUNT RD
7S/9E-29R1	GUSTINE	D	323 S. HUNT RD. NEWMAN
7S/9E-29R3	GUSTINE	D	28315 W. PRESTON RD. NEWMAN
7S/9E-32B1	GUSTINE	I	60 CANAL SCHOOL RD, NEWMAN
7S/9E-32H1	GUSTINE	D	185 N. CANAL SCHOOL RD, UNDER WINDMILL
7S/9E-32L	NEWMAN	D,S	185 N. CANAL SCHOOL RD, 15' W/WINDMILL
7S/9E-33E1	NEWMAN	D	294 S. HUNT RD, NEWMAN, UNDER WINDMILL
7S/9E-33E2	NEWMAN	D,S	416 S. HUNT RD, NEWMAN, 25' SE/HOUSE
7S/9E-33F1	GUSTINE	D,S	490 S. HUNT RD, NEWMAN, WINDMILL
7S/9E-34C	GUSTINE	S	100' E/SANTA FE GR @WINDMILL
7S/9E-36R	GUSTINE	I,W	KESTERSON NWR
8S/9E-1K	GUSTINE	I,W	KESTERSON NWR
8S/9E-2P1	GUSTINE	D	400' E/SANTA FE GRADE, 0.8 MI S/HWY 140
8S/9E-3B1	GUSTINE	D,S	0.45 MI N/HWY 140,.3 MI W/SF GR @ BARN
8S/9E-3K1	GUSTINE	I	500' N/HWY 140
8S/9E-4B1	GUSTINE	D	1130 S. KNIEBES RD, GUSTINE
8S/9E-4J	GUSTINE	D	.7 MI N/HWY 140, E SIDE KNIEBES RD
8S/9E-5J1	GUSTINE	D,S	1555 S. HUNT RD, 100' W/HUNT @ WINDMILL
8S/9E-5J2	GUSTINE	D,S	1555 S. HUNT RD, W/HUNT @ IRRIG DITCH
8S/9E-8J	GUSTINE	D	S/CARNATION RD. @ HUNT
8S/9E-9E1	GUSTINE	D	500 EAST AVE, GUSTINE
8S/9E-9E2	GUSTINE	D	IST HOUSE S/500 EAST AVE, GUSTINE
8S/9E-9E3	GUSTINE	D	100' N/CARNATION RD, .2 MI E/EAST AVE, GUSTINE
8S/9E-9N2	INGOMAR	D	D2807 S. HUNT GUSTINE @ HAND PUMP
8S/9E-11H1	GUSTINE	I,S,W	E/SANTA FE GR LONE TREE LEVEE RD
8S/9E-13D	INGOMAR	D	W. SIDE SANTA FE GR/.8 MI N/GUN CLUB RD
8S/9E-13E	INGOMAR	D	W. SIDE SANTA FE GR/.75 MI N/GUN CLUB RD@CABIN
8S/9E-13N	INGOMAR	S	N. SIDE GUN CLUB RD, W. OF GUSTINE CLUB
8S/9E-13P	INGOMAR	S,W	NE CORNER GUN CLUB RD & SANTA FE GRADE
8S/9E-14H1	INGOMAR	D	50' E/SANTA FE GRADE, .75 MI N/GUN CLUB RD
8S/9E-15D	INGOMAR	S	.5 MI E/KNIEBES RD, .5 MI S/CARNATION RD,WNDML
8S/9E-16G1	INGOMAR	I	MIDPOINT SECTION 16
8S/9E-16P1	INGOMAR	D,S	27506 GUN CLUB RD, GUSTINE
8S/9E-21A1	INGOMAR	I	.25 MI S/GUN CLUB RD,.25 MI W/AZEVEDO RD
8S/9E-21H1	INGOMAR	I	.5 MI S/GUN CLUB RD, W SIDE AZEVEDO RD
8S/9E-21R1	INGOMAR	S	25' N/ TAGLIO RD/E. INGOMAR GR @ WINDMILL
8S/9E-22B	INGOMAR	I	S. SIDE GUN CLUB RD/.7 MI E INGOMAR GRADE
8S/9E-22M1	INGOMAR	S	E. SIDE AZEVEDO RD, .4 MI N/TAGLIO RD
8S/9E-22N1	INGOMAR	I	NE CORNER TAGLIO & AZEVEDO RDS.
8S/9E-22Q	INGOMAR	I	.25 MI N/TAGLIO RD, .5 MI E AZEVEDO @ WINDMILL
8S/9E-24A1	INGOMAR	D	.1 MI S/GUN CLUB RD, NE OF CARETAKERS HOUSE
8S/9E-24A2	INGOMAR	D	.1 MI S/GUN CLUB RD, NE OF CARETAKERS HOUSE

ABANDONED WELLS

STATE WELL NO.	USGS 7.5' QUAD	FORMER USE	LOCATION
8S/9E-34F	INGOMAR	I	E/MOFFAT RD, .5 MI N/COTTONWOOD: WINDMILL
8S/9E-34Q	INGOMAR	D,S	15' E/MOFFAT RD, .1 MI N/COTTONWOOD
8S/10E-5M	GUSTINE	I,W	KESTERSON NWR
8S/10E-6D	GUSTINE	I,W	KESTERSON NWR
8S/10E-8P	INGOMAR	W	NW CORNER KESTERSON RESERVOIR POND 9
8S/10E-9F1	GUSTINE	I,W	KESTERSON NWR
8S/10E-8P	INGOMAR	W	NW CORNER KESTERSON RESERVOIR POND 9
8S/10E-9F1	GUSTINE	I,W	KESTERSON NWR
8S/10E-16E	INGOMAR	W	SE SIDE KESTERSON RESERVOIR POND 7
8S/10E-16P	INGOMAR	W	SE CORNER KESTERSON RESERVOIR POND 5
8S/10E-16Q1	SAN LUIS RANCH	D,S	E. END GUN CLUB RD
8S/10E-17K	INGOMAR	W	SE CORNER KESTERSON RESERVOIR POND 8
8S/10E-17N1	INGOMAR	D	50' N/GUN CLUB RD @ WEST BANK MUD SLOUGH
8S/10E-17N2	INGOMAR	D	60' N/GUN CLUB RD @ WEST BANK MUD SLOUGH
8S/10E-18N2	INGOMAR	D	.1 MI E/HOLLOW TREE CLUB, N/GUN CLUB RD
8S/10E-18R	INGOMAR	S,W	300' N/GUN CLUB RD, E. SANTA FE CANAL
8S/10E-20A1	INGOMAR	W	S. GUN CLUB RD @ FREMONT CANAL
8S/10E-20B1	INGOMAR	W	S. GUN CLUB RD @ FREMONT CANAL
8S/10E-21B1	SAN LUIS RANCH	W	E. END GUN CL RD, S/RD, W/SAN LUIS DRAIN
8S/10E-21B2	SAN LUIS RANCH	MONITOR	E. END GUN CL RD, S/RD, E/SAN LUIS DRAIN
8S/10E-22L1	SAN LUIS RANCH	S,I	.8 MI S/GUN CL RD, 200' E/SAN LUIS DRAIN
8S/10E-27H	SAN LUIS RANCH	S,W	50' W/LANDER AVE, 4.5 MI N/WOLFSEN RD
8S/10E-28C	INGOMAR	D	50' E/FREMONT CANAL, I MI S/GUN CLUB RD
8S/10E-29E	INGOMAR	W	E. SANTA FE CANAL @ EAGLE DITCH
8S/10E-29N	INGOMAR	W	500' W/SANTA FE CANAL, S MI S/ GUN CLUB RD
8S/10E-30A	INGOMAR	S	1.2 MI S/GUN CLUB RD, W/SANTA FE CANAL
8S/10E-30E	INGOMAR	D	W SIDE SANTA FE GRADE @ TRI CLUB
8S/10E-32R	INGOMAR	D	E/SANTA FE CANAL, S/KESTERSON DITCH
8S/10E-33A	SAN LUIS RANCH	S	.1 MI N/KESTERSON DITCH @ WINDMILL
8S/10E-34C	SAN LUIS RANCH	W	50' N/KESTERSON DITCH, .9 MI W/LANDER AVE
8S/10E-34D	SAN LUIS RANCH	D	50' N/KESTERSON DITCH, 1.5 MI W/LANDER AVE
8S/10E-34E	SAN LUIS RANCH	D	50' S/KESTERSON DITCH, 1.5 MI W/LANDER AVE
8S/10E-34Q	SAN LUIS RANCH	D,W	.75 MI W/LANDER AVE, W/UNDERWOOD CL
8S/10E-35F1	SAN LUIS RANCH	D	W. SIDE LANDER AVE, 3.75 MI N/WOLFSEN RD
8S/10E-35L	SAN LUIS RANCH	S,W	100' E CORRAL RD, .25 N/UNDERWOOD CLUB
9S/9E-14N1	SAN LUIS RANCH	I	@INGOMAR/JUST E/SOUTHERN PACIFIC RR
9S/10E-2D1	SAN LUIS RANCH	I	.75 MI W/CORRAL RD., S/LEVEE RD @ DUCK POND
9S/10E-2Q	SAN LUIS RANCH	W	250' W/CORRAL RD, 2 MI N/WOLFSEN RD
9S/10E-4D	INGOMAR	D	E/SANTA FE CANAL, .3 MI S/KESTERSON DITCH
9S/10E-4L	INGOMAR	D	E/SANTA FE CANAL, .75 MI S/KESTERSON DITCH
9S/10E-4Q	SAN LUIS RANCH	S,W	E/SANTA FE CANAL, 2.3 MI W/LANDER AVE
9S/10E-5A1	INGOMAR	S	WINDMILL/EAGLE WELL
9S/10E-5Q2	INGOMAR	D	50' E/SANTA FE GR/.6 MI N/PATMAN GRADE
9S/10E-6A2	INGOMAR	S,I	W SIDE SANTA FE GR @ T8S/T9S LINE
9S/10E-6G2	INGOMAR	W	3.25 MI E/INGOMAR GR, S/INGOMAR GR RD
9S/10E-7F	INGOMAR	I,S	1.5 MI N/SAN LUIS HOLD.RES.,.75 MI W/SAN LU WW
9S/10E-7K	INGOMAR	I,S	1.5 MI N/SAN LUIS HOLD RES,.25 MI W/SAN LU WW

ABANDONED WELLS

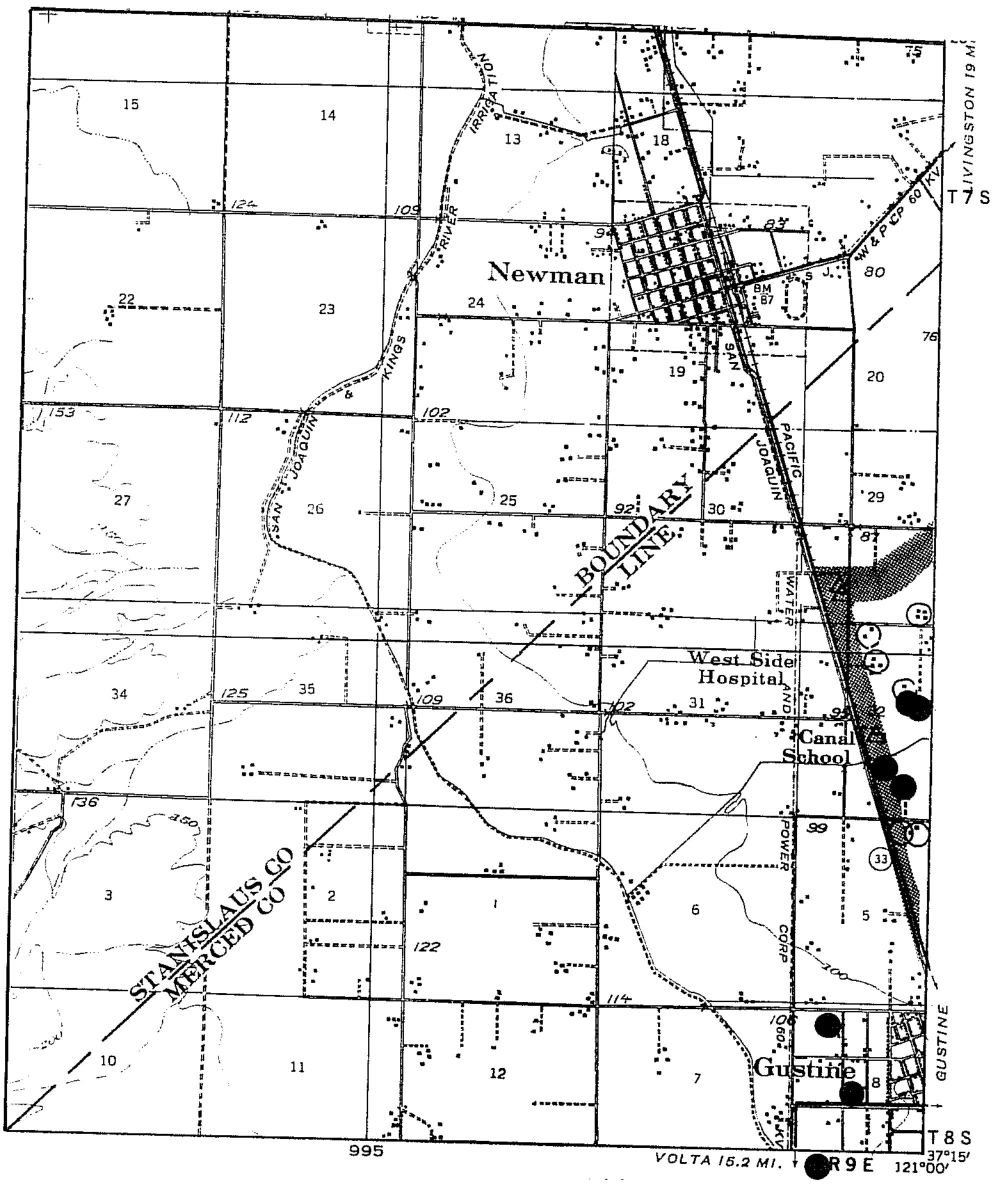
STATE WELL NO.	USGS 7.5' QUAD	FORMER USE	LOCATION
9S/10E-9R	SAN LUIS RANCH	S,W	50' W/SANTA FE CANAL, 250' W/EXETER FARMS
9S/10E-12E	SAN LUIS RANCH	S,W	W/CORRAL RD/1.5 MI N WOLFSEN RD
9S/10E-12M1	SAN LUIS RANCH	S,W	W/CORRAL RD, 1 MI N WOLFSEN RD
9S/10E-12M2	SAN LUIS RANCH	S,W	W/CORRAL RD, 1.2 MI N/WOLFSEN RD
9S/10E-15G1	SAN LUIS RANCH	S	2000' NE BM 85 & BEE ESS GUN CLUB, WINDMILL
9S/10E-16Q1	INGOMAR	I	50' W/SANTA FE GRADE, 300' N/SAN LU SPILLWAY
9S/10E-18G	INGOMAR	I,S	.5 MI N/SAN LUIS HOLD RES, .25 MI W/SAN LU WW
9S/10E-18M	INGOMAR	I,S	.4 MI N/SAN LUIS HOLD RES, 1 MI W/SAN LU WW
9S/10E-18N	INGOMAR	I,S	.1 MI N/SAN LUIS HOLD RES, 1 MI W/SAN LU WW
9S/11E-07F	SAN LUIS RANCH	D	E/SALT SL,.25 MI N/WOLFSEN RD BEHIND SHOP
9S/11E-07N	SAN LUIS RANCH	I	E/SALT SLOUGH @ WOLFSEN RD

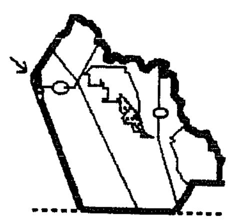
A P P E N D I X   C

WELL LOCATION MAPS

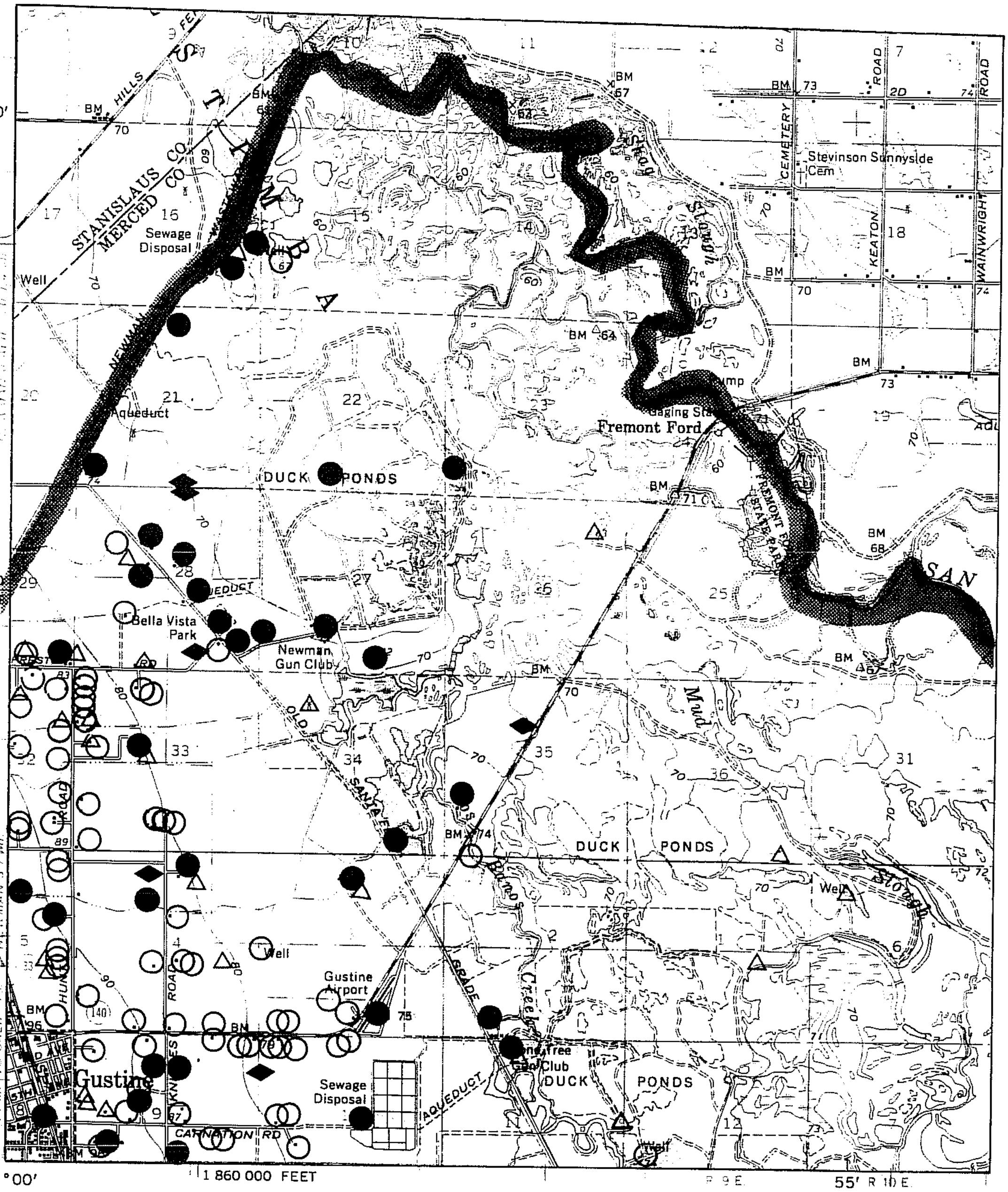
Codes for types of wells plotted on location maps.

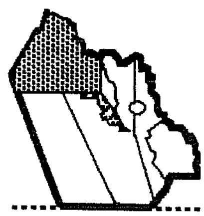
CODE	WELL TYPE
⊙	Active well.
●	Active well, water quality samples taken.
△	Abandoned well.
◆	Tile drain.



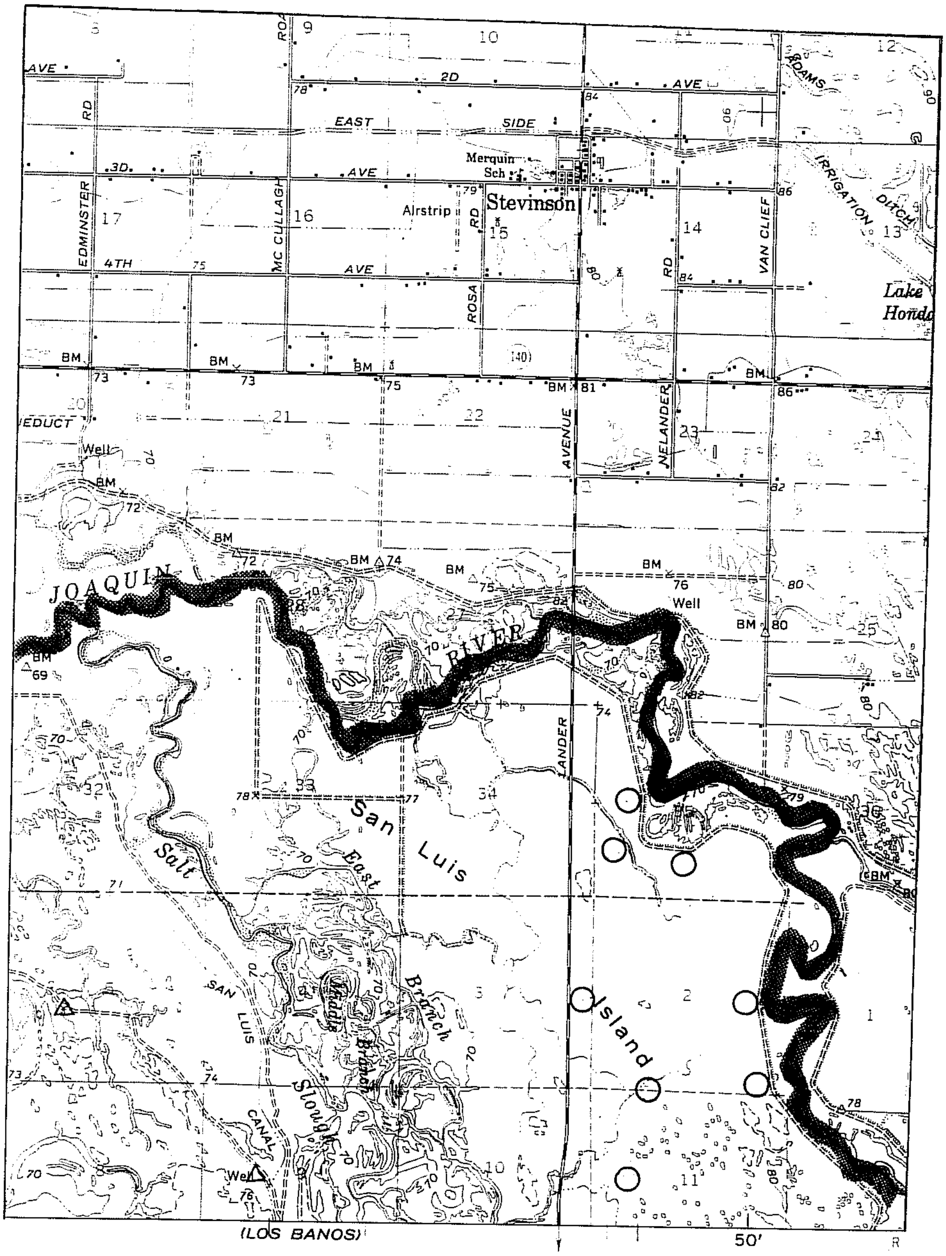


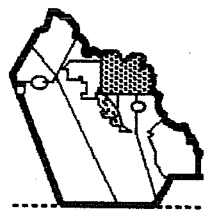
WELL LOCATION MAP A.





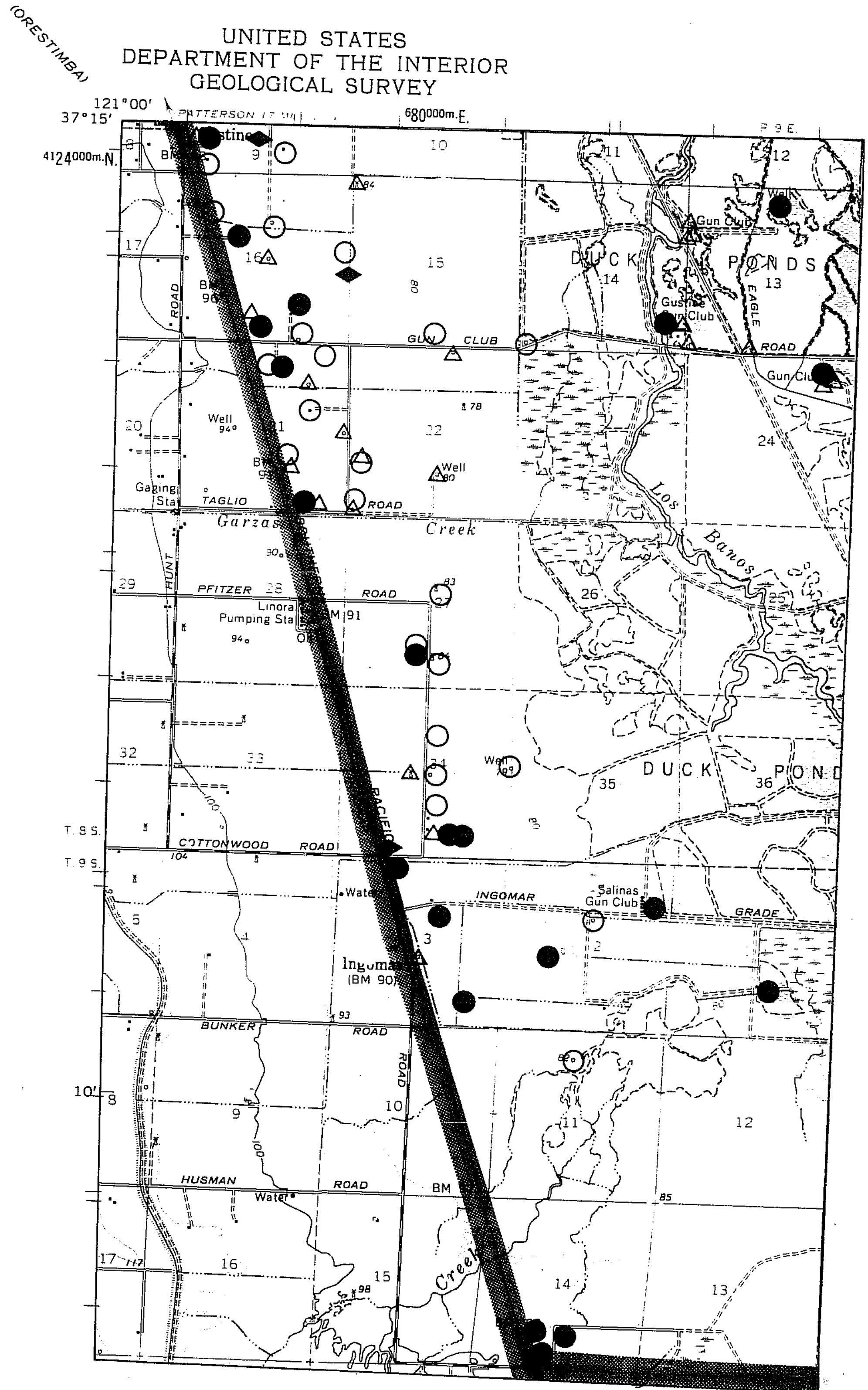
WELL LOCATION MAP B.

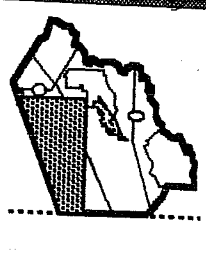




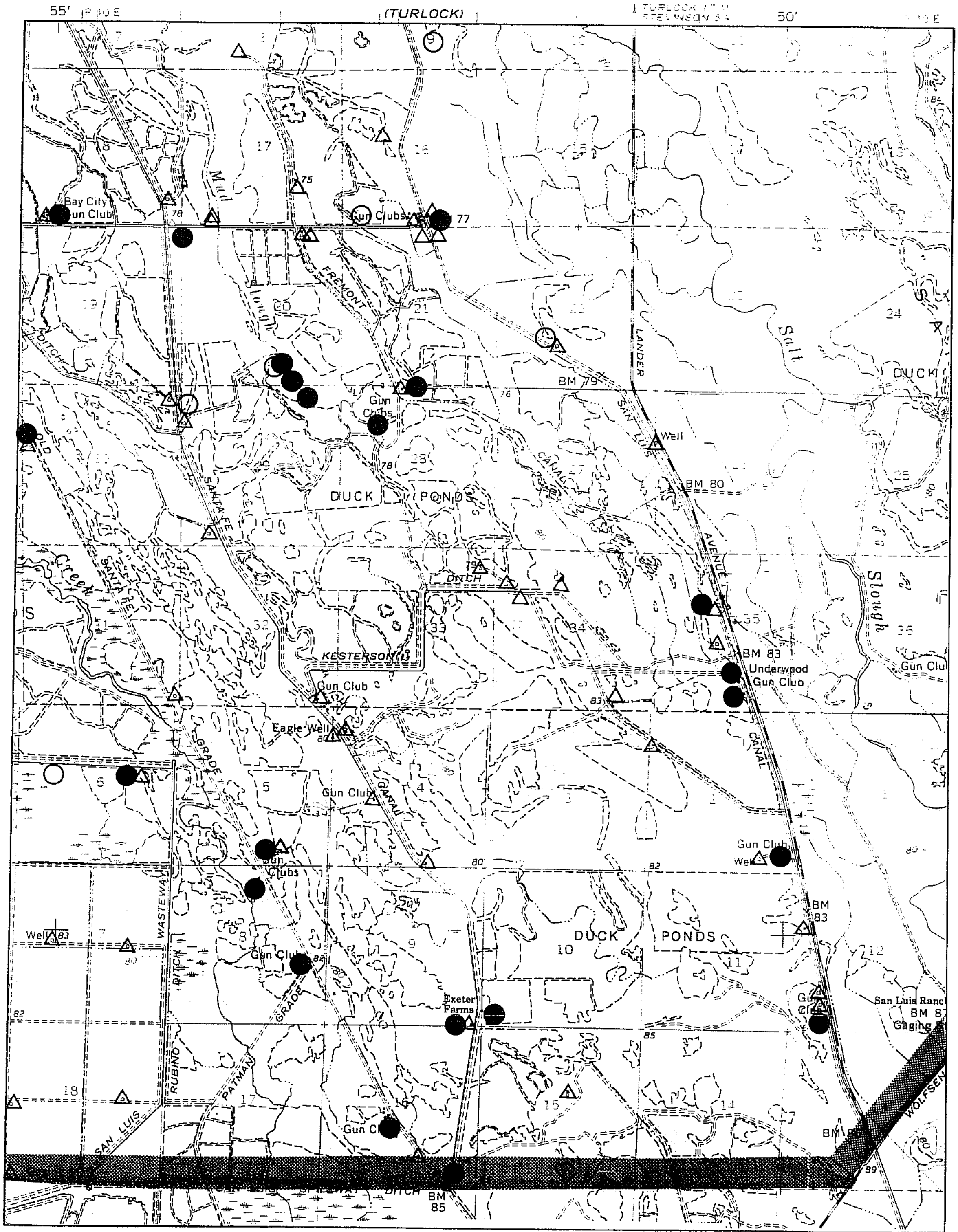
WELL LOCATION MAP C.

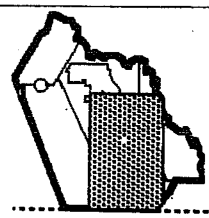
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY





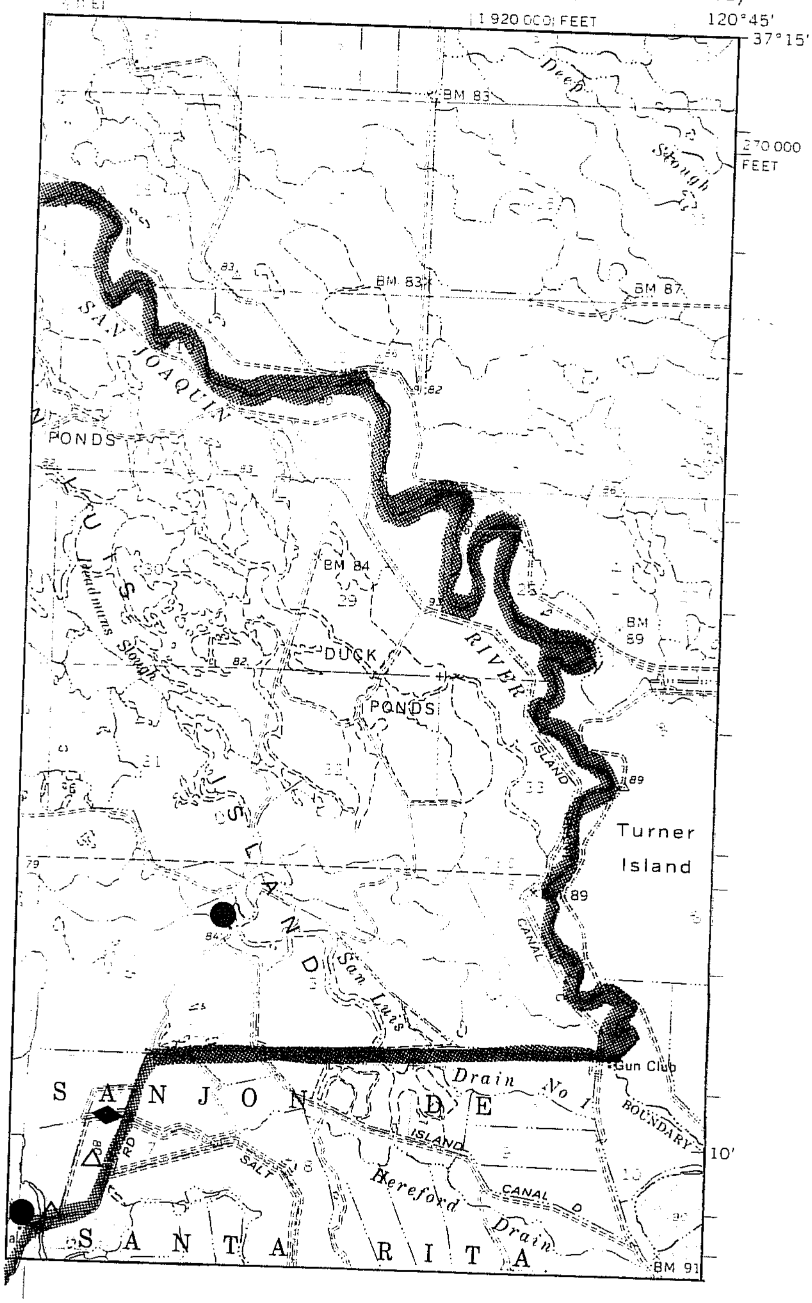
WELL LOCATION MAP D.



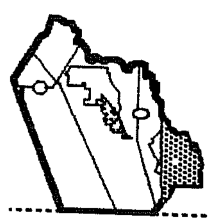


WELL LOCATION MAP E.

LOS BANOS QUADRANGLE
CALIFORNIA—MERCED CO.
15 MINUTE SERIES (TOPOGRAPHIC)



WELL LOCATION MAP F.



APPENDIX D

WATER QUALITY ANALYSIS
MINERALS

Codes for Tables in Appendix D.

AQ/WELL DEPTH

U Upper water-bearing zone (wells completed above the Corcoran Clay).

L Lower water-bearing zone (wells completed below the Corcoran Clay).

WATER USE

D Domestic.

D* Domestic, but bottled water used for drinking.

M Municipal.

S Stock Watering.

I Irrigation.

P Process.

W Wildlife Habitat.

Values in **Bold** type exceed water quality criteria for the existing beneficial uses of the water.

APPENDIX D. MINERAL ANALYSIS

STATE WELL NO.	DATE	AQ/WELL DEPTH-ft	WATER USE	Ca	Mg	Na	K	Cl	SO4	CO3	HCO3	Hard	TDS	EC	pH	B
							-----	mg/l	-----					µmos/cm		mg/l
7S/9E-16J1	6/23/87		I,S	126	77	229	4.9	445	490	0	157	630	1452	2310	8.3	1.2
7S/9E-16J2	6/23/87	L/430	I,S	143	105	409	8.5	985	1265	6	165	801	3368	4870	8.4	2.2
7S/9E-21C	6/23/87		I,S	94	57	138	5.6	440	445	4	102	467	1284	2110	8.4	2.5
7S/9E-21N	6/24/87	U	D,S	60	27	58	2.1	73	145	0	153	262	564	832	8.3	0.2
7S/9E-22P	6/15/87	U	**I,S,W**	90	54	335	6.7	432	565	0	104	448	1444	2410	7.9	**3.2**
7S/9E-23N	7/30/87	U/45	S,W	71	37	400	4	280	500	2	120	380	1400	2200	8.2	2.6
7S/9E-27P	6/15/87	U	D,S	37	25	61	2	50	132	0	163	195	432	793	7.9	0.4
7S/9E-27N	8/25/87	L/450	I	69	25	72	1.8	73	170	0	180	310	600	860	8.0	0.3
7S/9E-27Q	6/15/87	U	I,W	126	61	246	4.2	264	635	0	154	564	1328	2040	8.0	0.8
7S/9E-28E	10/15/87	U/190	D											600		
7S/9E-28F1	6/24/87	U/120	D	87	39	70	2.3	98	235	0	158	378	740	1100	8.3	0.2
7S/9E-28F2	7/30/87	U/180	D,S	81	32	66	1.7	68	170	0	150	300	570	890	8.0	0.3
7S/9E-28G	6/24/87	U/114	D,S	98	44	86	2.7	151	283	4	154	425	850	1255	8.4	0.6
7S/9E-28J	7/20/87	U/25	D,S	58	32	66	1.7	50	150	0	170	290	570	860	8.0	0.3
7S/9E-28K	6/24/87	U/86	D,S	49	28	57	1.9	81	155	26	134	236	444	738	8.9	0.2
7S/9E-28L	10/15/87	U/153	D,S											1810		
7S/9E-28R1	6/24/87	U/188	D,P	63	31	66	2.6	130	155	0	158	286	596	936	8.6	0.3
7S/9E-28R2	10/15/87		D,S											890		
7S/9E-29R2	7/30/87	U/153	D,S	91	37	71	1.9	89	150	0	190	330	620	1000	8.1	0.3
7S/9E-29R4	10/15/87	U/146	D											1950		
7S/9E-32A1	10/15/87		D,S											3200		
7S/9E-32A2	10/15/87	U/150	D,S											900		
7S/9E-32B2	10/15/87	U/137	D											1180		
7S/9E-32C2	10/15/87	U/210	D											820		
7S/9E-32G4	10/15/87		D,S											1640		
7S/9E-32G1	7/30/87	U/137	I	110	52	99	2	120	190	0	240	420	810	1300	8.1	0.5
7S/9E-32G2	7/30/87	U	D	75	39	110	1.3	110	110	0	220	320	660	1100	8.2	0.6
7S/9E-32H2	10/15/87		D											860		
7S/9E-32H3	10/15/87		D,S											2160		
7S/9E-32J	10/15/87		D											1010		
7S/9E-32L1	8/31/87	U	I					130	180	0	190			1300		0.5
7S/9E-32Q1	10/15/87	U/140	D,S											1030		

APPENDIX D. MINERAL ANALYSIS

STATE WELL NO.	DATE	AQ/WELL DEPTH-ft	WATER USE	Ca	Mg	Na	K -----	Cl mg/l	SO4 -----	CO3	HCO3	Hard	TDS	EC µmos/cm	pH	B mg/l
7S/9E-32Q3	7/30/87	U	D	140	59	110	2.2	180	260	0	240	580	1000	1700	8.0	0.5
7S/9E-32R	10/15/87		D,S											1080		
7S/9E-33C1	10/15/87	U/110	D,S											890		
7S/9E-33C2	10/15/87	U/160	D											970		
7S/9E-33D1	10/15/87	U/155	D											1960		
7S/9E-33D2	10/15/87	U/146	D											900		
7S/9E-33D3	10/15/87	U/90	D											1114		
7S/9E-33E4	10/15/87		D											1304		
7S/9E-33E5	10/15/87	U/80	D											5180		
7S/9E-33F2	7/30/87	U/80	D	92	40	73	2.1	87	150	0	220	380	660	1200	8.2	0.3
7S/9E-33N1	10/15/87	U/210	D,S											1850		
7S/9E-33N2	10/15/87	U/140	D											925		
7S/9E-33P1	10/15/87	U/156	D,S											1210		
7S/9E-34Q	6/24/87	L/670	**D,S,W**	87	51	30	6.1	390	475	0	103	424	**1324**	2040	7.9	2.9
7S/9E-35M	6/29/87	L/580	**D,I**	83	37	340	3.8	320	500	0	130	360	**1400**	2200	8.2	2.8
8S/9E-2N	6/3/87	L/630	**I,S,W**	80	44	222	7.8	530	187	0	122	382	**1132**	1900	8.0	2.9
8S/9E-2P1	6/4/87	L/675	D	69	32	85	5.4	89	225	0	136	304	588	996	8.4	0.4
8S/9E-3C	7/30/87	L/470	**D,S**	89	46	270	3.3	320	260	0	130	380	**1100**	2000	8.2	1.8
8S/9E/3N2	10/15/87	U/200	D											698		
8S/9E-3P1	10/15/87		D											1400		
8S/9E-3Q	7/29/87	U	M	70	31	76	2.6	50	190	0	140	280	580	900	8.0	0.3
8S/9E-4B2	7/29/87	U/83	**D**	240	180	320	2.4	240	1100	0	200	1300	**2600**	3300	8.1	1.3
8S/9E-4F	7/29/87	U/250	**D**	130	71	95	2.1	150	370	0	150	640	**1100**	1600	7.9	0.3
8S/9E-4G	10/15/87	U	D											584		
8S/9E-4K1	10/15/87	U/130	D,S											1075		
8S/9E-4K2	10/15/87		D,S											1099		
8S/9E-4L	10/15/87		D,S											1870		
8S/9E-4N	10/15/87		D											1464		
8S/9E-4P	10/15/87		D											773		
8S/9E-4Q	10/15/87	U/98	D,S											836		
8S/9E-4R	10/15/87	U/190	D											618		
8S/9E-5A	10/15/87	U/140	D											722		
8S/9E-5B1	7/30/87	U/112	I	120	54	120	2.1	135	175	0	280	445	920	1600	8.1	0.5
8S/9E-5B2	10/15/87	U/97	D,P											1970		

APPENDIX D. MINERAL ANALYSIS

STATE WELL NO.	DATE	AQ/WELL DEPTH-ft	WATER USE	Ca	Mg	Na	K -----	Cl mg/l	SO4 -----	CO3	HCO3	Hard	TDS	EC µmos/cm	pH	B mg/l
8S/9E-5B3	10/15/87		D											1310		
8S/9E-5H1	7/29/87	U/167	D,S	90	44	84	2.1	110	200	0	190	360	740	1200	8.0	0.4
8S/9E-5H2	10/15/87	U/137	D,S											1378		
8S/9E-5J3	10/15/87	U/147	D,S											1696		
8S/9E-5J4	10/15/87	U/150	D											1908		
8S/9E-5J5	10/15/87	U/165	D											1567		
8S/9E-5R	10/15/87	U	D,S											1554		
8S/9E-8D1	7/29/87	U/120	M,P	120	51	89	2.2	130	120	0	290	420	780	1300	7.7	0.4
8S/9E-8F1	7/29/87	U/123	M,P	100	45	87	2	120	110	0	250	370	700	1200	8.0	0.4
8S/9E-8H3	7/29/87	U/130	M,P	81	36	80	2	110	97	0	220	280	610	1000	8.1	0.4
8S/9E-8N	7/29/87	U/250	M,P	65	24	65	2.2	120	110	0	190	230	470	760	8.2	0.3
8S/9E-9A1	10/15/87	U/157	D											572		
8S/9E-9A2	10/15/87	U/220	D											578		
8S/9E-9B1	7/23/87	U/180	**D**	170	88	130	1.5	180	560	0	210	740	**1500**	2100	8.2	0.7
8S/9E-9B2	10/15/87		D											640		
8S/9E-9D	10/15/87	U/100	D											1477		
8S/9E-9C1	7/23/87	U/75	D	62	28	58	1.5	28	140	0	170	250	490	780	8.2	0.4
8S/9E-9F1	7/23/87	U/233	D,I	78	30	71	2.5	55	200	0	150	300	620	960	8.2	0.4
8S/9E-9F2	10/15/87	U/30	D											781		
8S/9E-9G	10/15/87	U/75	D,S											1683		
8S/9E-9K1	10/15/87	U/82	D,S											921		
8S/9E-9K3	8/31/87	U	I					120	200	0	240			1200		0.9
8S/9E-9M1	8/18/87	L/496	D	73	33	130	2.3	130	200	0	180	280	700	1150	7.8	0.6
8S/9E-9M2	8/18/87		D	64	28	74	1.7	80	80	0	210	240	480	880	7.8	0.4
8S/9E-9M3	7/23/87	U/90	D	110	48	86	1.8	140	150	0	240	390	780	1400	8.2	0.5
8S/9E-9N1	7/23/87		D,S	130	65	100	1.9	160	190	0	330	480	990	1700	8.1	0.8
8S/9E-9N3	10/15/87		D											926		
8S/9E-9Q	10/15/87		D*,S											2390		
8S/9E-10C1	10/15/87	U/80	D											554		
8S/9E-10C2	10/15/87		D											526		
8S/9E-10D1	10/15/87	U/127	D											1664		
8S/9E-10D2	10/15/87	U/130	D											610		
8S/9E-10D3	10/15/87		D											553		
8S/9E-10E1	10/15/87		D											540		

STATE WELL NO.	DATE	AQ/WELL DEPTH-ft	WATER USE	Ca	Mg	Na	K -----	Cl mg/l	SO4 -----	CO3	HCO3	Hard	TDS	EC µmos/cm	pH	B mg/l
8S/9E-10E2	10/15/87		S											521		
8S/9E-10G	7/29/87	U/150	M	49	24	86	2.3	48	110	0	180	200	480	790	8.3	0.4
8S/9E-10M	10/15/87		D,S,I											718		
8S/9E-13B	6/29/87	L/793	W	100	37	540	4.4	500	560	0	100	402	1900	3200	8.0	2.8
8S/9E-14R1	6/24/87	U/213	**D**	175	116	265	6.9	915	450	0	167	911	**1960**	3220	8.0	0.9
8S/9E-16D	10/15/87	U/150	**D,S**											1602		
8S/9E-16F	7/23/87	U/25	D*	110	130	180	0.78	300	300	0	400	780	1500	2400	8.1	1.2
8S/9E-16P2	7/22/87	U/100	D,S	51	26	80	1.2	75	95	0	210	240	550	910	8.3	0.6
8S/9E-16Q1	10/15/87		D,S											784		
8S/9E-16Q2	7/22/87	U	D	72	40	110	1.3	140	180	0	240	350	790	1400	8.1	0.8
8S/9E-21A2	10/15/87	U/90	D											718		
8S/9E-21B1	6/30/87	U/216	D,S	67	31	77	1.8	73	120	0	220	295	560	880	8.2	0.4
8S/9E-21R2	6/30/87	U/125	S	91	54	150	1.8	180	280	0	240	449	960	1600	8.0	0.6
8S/9E-22M2	10/15/87		S											597		
8S/9E-24A3	6/4/87	L/450	**D,S,I**	68	32	210	6.5	510	260	0	166	302	**1280**	2030	8.4	**3.1**
8S/9E-27P	8/25/87	U/44	S					790	1300	8	500			4800	7.4	7.6
8S/9E-34Q1	6/4/87	U/188	D,S	48	34	104	4.1	107	140	0	214	256	556	976	8.0	1.3
8S/9E-34Q2	6/4/87	L/440	D,S	46	32	99	4.8	98	115	0	206	247	572	934	8.1	1.2
8S/10E-16Q2	5/19/87	L/295	**D,I,S**					575	700					3540		**3.1**
8S/10E-16Q2	7/22/87	L/295	**D,I,S**	80	36	610	3.2	560	560	0	150	410	**2200**	3500	8.0	2.9
8S/10E-18N1	6/24/87	U/60	**D**	64	25	221	4.9	270	445	0	143	261	**1180**	1780	8.3	2.8
8S/10E-19A1	6/4/87	U/90	**D***	114	62	436	9.3	1095	693	0	175	541	**2644**	4060	8.1	3.9
8S/10E-20Q2	6/30/87	U/60	D	64	21	330	2.8	210	470	0	160	246	1200	1800	8.2	3.1
8S/10E-28B	7/22/87	L/700	**D,W**	55	10	390	2.5	190	480	0	140	150	**1200**	2000	8.2	2.4
8S/10E-28E	6/30/87	U/70	**D*,I**	110	84	650	3.6	680	760	0	500	620	2500	3800	7.8	**4.3**
8S/10E-29A	6/30/87	L/370	**D,I**	59	18	320	2.8	200	450	0	160	221	1200	1800	8.1	**3.2**
8S/10E-29B	10/15/87	U/80	I,W											8200	7.7	
8S/10E-30E2	6/4/87	U/83	**D*,W**	115	150	587	9.8	945	261	0	210	902	**4100**	6330	8.0	2.7
8S/10E-35F2	6/3/87	L	**D**	35	6	255	4.3	485	129	0	162	113	**1084**	1820	8.2	2.8
8S/10E-35Q1	6/30/87	U/27	S	170	71	610	3.6	560	840	0	520	717	2500	3600	7.8	4.8
8S/10E-35Q2	6/30/87	U/38	D*	280	150	880	7.8	900	1400	0	690	1317	4200	5500	7.7	7.0
9S/9E-1K	6/30/87	U/25	D*	380	800	2100	7.1	4400	1800	0	300	3528	10000	16000	7.7	8.5
9S/9E-2A	6/4/87	L/445	**D**	90	41	180	7.3	378	290	0	123	391	**1048**	1830	8.2	1.9
9S/9E-2L1	6/23/87	L/500	I,S	52	31	244	4.3	270	115	38	122	256	668	1170	8.9	1.2

STATE WELL NO.	DATE	AQ/WELL DEPTH-ft	WATER USE	Ca	Mg	Na	K	Cl	SO4	CO3	HCO3	Hard	TDS	EC	pH	B
							-----	mg/l	-----					µmos/cm		mg/l
9S/9E-3C1	6/30/87	L/490	S,I	125	62	350	3.3	665	170	0	160	566	1550	2800	7.8	2.2
9S/9E-3G	6/23/87	L/409	D,I,S	66	33	193	3	385	99	0	151	301	800	1360	8.3	0.9
9S/9E-3R1	6/23/87	L/350	I,S	104	47	317	5.2	980	155	0	156	453	1624	2900	8.2	2.0
9S/9E-14P1	6/29/87		D	59	34	140	1.7	220	80	0	210	287	650	1200	8.1	1.5
9S/9E-14P2	6/29/87		I	55	42	160	1.6	250	96	0	230	310	740	1300	8.0	1.4
9S/9E-14Q	6/29/87		D,S	66	46	175	1.9	240	98	0	230	353	820	1450	8.0	1.6
9S/10E-2R	6/24/87		**D ***	127	107	543	12.2	1323	528	0	244	756	**2850**	4615	8.1	1.0
9S/10E-5Q	6/3/87	U/165	**D,I**	99	73	251	6.9	456	435	0	227	546	**1512**	2420	8.1	1.8
9S/10E-6H	7/22/87	L/633	**D,W**	110	110	525	3.3	580	560	0	190	680	**2200**	3550	8.0	2.2
9S/10E-8B	6/2/87	U/175	**D ***	87	65	188	6.3	445	345	0	190	483	**1344**	2120	8.1	1.2
9S/10E-8J	6/3/87	L/514	**D*,S**	51	28	242	6.1	216	370	0	193	241	**1104**	1720	8.2	2.8
9S/10E-9R	6/3/87	L/400	**D,S**	122	141	600	12	974	1598	0	506	880	**4000**	5905	8.2	4.6
9S/10E-10N	6/2/87	U/155	**D,S**	187	142	510	11.4	826	1330	0	223	1048	**3304**	4800	7.9	2.6
9S/10E-12N	6/24/87	U/160	**D,I**	258	232	809	13.5	2160	1170	0	172	1594	**4748**	6920	7.6	2.4
9S/10E-16L	6/3/87	U/230	**D ***	131	99	210	8	538	635	0	210	736	**1516**	2930	8.1	1.1
9S/10E-16R	6/2/87	U/222	**D,S**	96	68	131	5.8	266	360	0	229	518	**1136**	1760	8.1	1.1
9S/11E-6H	6/3/87		D	9	6	93	3.3	126	70	0	97	46	408	699	8.0	0.3
9S/11E-7N1	6/2/87	L/420	**D,I,S**	36	7	287	4	192	438	0	164	118	**1096**	1800	8.2	2.5
TS @ 7S/9E-28B1	8/31/87	U/<10	(TILE)					210	430	0	530			2450		2.2
TS @ 7S/9E-28B2	8/31/87	U/<10	(TILE)					330	870	0	420			3290		2.7
TS @ 7S/9E-28Q	8/31/87	U/<10	(TILE)					680	3600	0	490			8150		5.7
TS @ 7S/9E-35F	6/29/87	U/<10	(TILE)	260	360	1900	4.4	1900	2700	0	430	2131	7700	10000	7.5	7.5
TS @ 8S/9E-4C	8/31/87	U/<10	(TILE)					150	110	0	140			1043		0.6
TS @ 8S/9E-9P	7/23/87	U/<10	(TILE)	82	64	140	2.4	150	210	0	340	440	960	1700	8.1	1.0
TS @ 8S/9E-15M	8/31/87	U/<10	(TILE)					350	470	0	420			2730		1.9
TS @ 8S/9E-34P	7/22/87	U/<10	(TILE)	70	66	250	6.9	200	320	0	340	410	1200	2000	7.9	2.0
TS @ 9S/11E-7F	8/31/87	U/<10	(TILE)					190	170	0	200			1150		0.3

A P P E N D I X   E

WATER QUALITY ANALYSIS
TOTAL RECOVERABLE TRACE ELEMENTS

Codes for Tables in Appendix E.

AQ/WELL DEPTH

- U Upper water-bearing zone (wells completed above the Corcoran Clay).
- L Lower water-bearing zone (wells completed below the Corcoran Clay).

WATER USE

- D Domestic.
- D* Domestic, but bottled water used for drinking.
- M Municipal.
- S Stock Watering.
- I Irrigation.
- P Process.
- W Wildlife Habitat.

Values in **Bold** type exceed water quality criteria for the existing beneficial uses of the water.

APPENDIX E. TRACE ELEMENT ANALYSIS

STATE WELL NO.	DATE	AQ/WELL DEPTH-ft	WATER USE	Se	Mo	Cu	Cr	Pb	Ni	Zn
							µg/l			
7S/9E-16J1	6/23/87		I,S	1.7	4	4	6	<5	<5	50
7S/9E-16J2	6/23/87	L/430	I,S	2.5	3	<1	<1	<5	<5	<1
7S/9E-21C	6/23/87		I,S	0.5	8	<1	2	<5	<5	<1
7S/9E-21N	6/24/87	U	D,S	3.1	<1	15	<1	<5	<5	70
7S/9E-22P	6/15/87	U	I,S,W	0.9	26	1	<1	<5	<5	1
7S/9E-23N	7/30/87	U/45	S,W	1.3	23	300	8	24	16	22
7S/9E-27P	6/15/87	U	D,S	3.5	2	<1	15	<5	<5	9
7S/9E-27N	8/25/87	L/450	I	3.1	2	35	22	<5	10	11
7S/9E-27Q	6/15/87	U	**I,W**	**2.7**	2	9	**70**	<5	9	17
7S/9E-28F1	6/24/87	U/120	D	4.6	1	<1	12	<5	<5	28
7S/9E-28F2	7/30/87	U/180	D,S	2.7	1	<1	13	<5	<5	6
7S/9E-28G	6/24/87	U/114	D,S	3.0	1	1	17	<5	<5	180
7S/9E-28J	7/20/87	U/25	D,S	3.3	1	<1	18	<5	<5	60
7S/9E-28K	6/24/87	U/86	D,S	3.7	1	9	22	<5	<5	130
7S/9E-28R	6/24/87	U/188	D,P	2.0	1	<1	12	<5	<5	54
7S/9E-29R2	7/30/87	U/153	D,S	1.9	1	<1	12	<5	<5	10
7S/9E-32G1	7/30/87	U/137	I	3.0	1	6	24	10	12	730
7S/9E-32G2	7/30/87	U	D	1.7	1	<1	1	<5	<5	96
7S/9E-32L1	8/31/87	U	I	2.0	0					
7S/9E-32Q3	7/30/87	U	D	3.5	1	4	10	<5	<5	170
7S/9E-33F2	7/30/87	U/80	D	2.2	1	14	6	<5	<5	200
7S/9E-34Q	6/24/87	L/670	D,S,W	0.4	13	<1	<1	<5	<5	<1
7S/9E-35M	6/29/87	L/580	D,I	0.6	26	<1	<1	<5	<5	1
8S/9E-2N	6/3/87	L/630	I,S,W	0.5	16	<1	<1	<5	<5	<1
8S/9E-2P1	6/4/87	L/675	D	4.3	1	<1	17	<5	<5	16
8S/9E-3C	7/30/87	L/470	D,S	0.5	4	<1	<1	<5	<5	66
8S/9E-3Q	7/29/87	U	M	3.8	1	<1	19	<5	<5	35
8S/9E-4B2	7/29/87	U/83	D	3.0	1	2	16	<5	<5	620
8S/9E-4F	7/29/87	U/250	D	4.0	1	6	20	<5	<5	110
8S/9E-5B1	7/30/87	U/112	I	1.3	1	1	5	<5	<5	57
8S/9E-5H1	7/29/87	U/167	D,S	2.5	1	2	13	<5	<5	25

APPENDIX E. TRACE ELEMENTS

STATE WELL NO.	DATE	AQ/WELL DEPTH-ft	WATER USE	Se	Mo	Cu	Cr	Pb	Ni	Zn
				µg/l						
8S/9E-8D	7/29/87	U/120	M,P	0.7	1	6	10	<5	<5	14
8S/9E-8F1	7/29/87	U/123	M,P	0.8	1	<1	8	<5	<5	6
8S/9E-8H3	7/29/87	U/130	M,P	1.0	1	<1	10	<5	<5	<1
8S/9E-9B1	7/23/87	U/180	D	2.7	2	<1	15	17	<5	160
8S/9E-9C1	7/23/87	U/75	D	2.8	1	3	26	<5	<5	9
8S/9E-9F1	7/23/87	U/233	D,I	3.5	1	<1	15	10	<5	19
8S/9E-9K3	8/31/87	U	I	1.8	2					
8S/9E-9M1	8/18/87	L/496	D	1.3	2	<1	8	<5	<5	16
8S/9E-9M2	8/18/87		D	2.7	1	4	12	<5	<5	46
8S/9E-9M3	7/23/87	U/90	D	1.0	1	<1	10	24	<5	43
8S/9E-9N1	7/23/87		D,S	1.8	1	<1	10	19	<5	36
8S/9E-10G	7/29/87	U/150	**M**	3.6	1	**1400**	40	27	14	1700
8S/9E-13B	6/29/87	L/793	W	0.8	34	<1	<1	<5	<5	<1
8S/9E-14R1	6/24/87	U/213	D	3.8	1	1	13	<5	<5	<1
8S/9E-16F	7/23/87	U/25	D*	0.9	7	1	5	8	<5	45
8S/9E-16P2	7/22/87	U/100	D,S	1.7	2	<1	14	<5	<5	3
8S/9E-16Q2	7/22/87	U	D	1.5	2	<1	14	<5	<5	3
8S/9E-21B1	6/30/87	U/216	D,S	2.4	4	<1	19	<5	<5	<1
8S/9E-21R2	6/30/87	U/125	S	1.0	4	<1	10	<5	<5	60
8S/9E-24A3	6/4/87	L/450	D,S,I	0.5	18	<1	<1	<5	<5	550
8S/9E-27P	8/25/87	U/44	S	2.8	25					
8S/9E-34Q1	6/4/87	U/188	D,S	1.4	2	<1	16	<5	<5	3
8S/9E-34Q2	6/4/87	L/440	D,S	1.4	2	3	15	<5	<5	7
8S/10E-16Q2	5/19/87	L/295	D,I,S	0.3	21	<1	<1	<5	<5	21
8S/10E-16Q2	7/22/87	L/295	D,I,S	0.6	20	<1	<1	<5	<5	8
8S/10E-18N1	6/24/87	U/60	D	0.3	20	<1	<1	<5	<5	11
8S/10E-19A1	6/4/87	U/90	D*	0.8	19	1	<1	<5	<5	90
8S/10E-20Q2	6/30/87	U/60	D	0.2	19	<1	<1	<5	<5	1
8S/10E-28B	7/22/87	L/700	D,W	1.2	19	20	4	20	<5	31
8S/10E-28E	6/30/87	U/70	D*,I	1.1	70	<1	<1	7	<5	330
8S/10E-29A	6/30/87	L/370	D,I	0.5	20	6	<1	<5	<5	300
8S/10E-29B	10/15/87	U/80	I,W	0.6	21	<1	<1	<5	<5	1
8S/10E-30E2	6/4/87	U/83	**D*, W**	1.4	5	39	7	<5	9	**60**
8S/10E-35F2	6/3/87	L	D	0.4	34	4	<1	<5	<5	1

APPENDIX E. TRACE ELEMENTS

STATE WELL NO.	DATE	AQ/WELL DEPTH-ft	WATER USE	Se	Mo	Cu	Cr	Pb	Ni	Zn
				µg/l						
8S/10E-35Q1	6/30/87	U/27	S	1.6	34	<1	<1	<5	<5	46
8S/10E-35Q2	6/30/87	U/38	D*	1.8	24	14	<1	<5	<5	800
8S/9E-8N	7/29/87	U/250	M,P	2.1	1	<1	11	<5	<5	<1
9S/9E-1K	6/30/87	U/25	D*	0.2	5	2	<1	<5	<5	80
9S/9E-2A	6/4/87	L/445	D	0.6	4	<1	<1	<5	<5	8
9S/9E-2L1	6/23/87	L/500	I,S	0.2	3	<1	<1	<5	<5	6
9S/9E-3C1	6/30/87	L/490	S,I	0.4	4	<1	3	<5	<5	<1
9S/9E-3G	6/23/87	L/409	D,I,S	0.7	2	4	2	<5	<5	25
9S/9E-3R1	6/23/87	L/350	I,S	0.4	6	2	<1	<5	<5	150
9S/9E-14P1	6/29/87		D	2.1	1	11	38	<5	28	21
9S/9E-14P2	6/29/87		I	0.8	1	4	38	<5	<5	27
9S/9E-14Q	6/29/87		D,S	0.9	2	1	17	7	<5	32
9S/10E-2R	6/24/87		D*	1.0	3	4	2	<5	<5	70
9S/10E-5Q	6/3/87	U/165	D,I	0.5	11	<1	<1	10	<5	400
9S/10E-6H	7/22/87	L/633	D,W	1.0	5	2	2	6	6	14
9S/10E-8B	6/2/87	U/175	D*	0.3	4	<1	<1	<5	<5	6
9S/10E-8J	6/3/87	L/514	D*,S	0.5	14	<1	<1	<5	<5	60
9S/10E-9R	6/3/87	L/400	D,S	0.9	50	<1	<1	<5	<5	1
9S/10E-10N	6/2/87	U/155	D,S	0.4	10	1	<1	<5	<5	140
9S/10E-12N	6/24/87	U/160	D,I	0.5	7	2	1	<5	<5	42
9S/10E-16L	6/3/87	U/230	D*	1.6	3	43	4	11	<5	2600
9S/10E-16R	6/2/87	U/222	D,S	1.0	6	<1	<1	<5	<5	17
9S/11E-6H	6/3/87		D	0.2	19	<1	<1	<5	<5	180
9S/11E-7N1	6/2/87	L/420	D,I,S	0.5	30	<1	<1	<5	<5	7
TS @ 7S/9E-28B1	8/31/87	U/<10	(TILE DRAIN)	1.1	8					
TS @ 7S/9E-28B2	8/31/87	U/<10	(TILE DRAIN)	1.7	10					
TS @ 7S/9E-28Q	8/31/87	U/<10	(TILE DRAIN)	8.6	29					
TS @ 7S/9E-35F	6/29/87	U/<10	(TILE DRAIN)	0.7	34	2	<1	<5	<5	6
TS @ 8S/9E-4C	8/31/87	U/<10	(TILE DRAIN)	1.4	5					
TS @ 8S/9E-9P	7/23/87	U/<10	(TILE DRAIN)	1.0	2	2	<5	<5	<5	1
TS @ 8S/9E-15M	8/31/87	U/<10	(TILE DRAIN)	0.3	11					
TS @ 8S/9E-34P	7/22/87	U/<10	(TILE DRAIN)	3.4	7	2	3	23	<5	4
TS @ 9S/11E-7F	8/31/87	U/<10	(TILE DRAIN)	0.4						